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INDIAN FARMING

JULY, 1949

Vol. X No. 7

FOREST PROBLEMS OF ASIA*

THE F.A.O. deserves our appreciation for organizing this Regional Conference to deal with certain basic problems affecting the economic life of so many nations. Through these conferences F.A.O. endeavours to play its part in raising the standard of living of the common man. It is in a way in the fitness of things that the first Regional Conference on Forestry for Asia and the Pacific should be held in India. Forests have played a part in the social and spiritual life of our country which they may not have played elsewhere. Wise men in India did not look upon forests simply as an unwanted waste of land which man can put to better use or as the abode of wild untamed lives hostile to human peace and welfare. In the eyes of India's sages forests had a great place in the life of man. They could serve his physical needs and they could serve his spiritual needs also. It is in the forests more than on the field that man is brought closer to nature. Out of that close contact emerges a balanced judgment on the varieties of human life and one is better able to fix man's place in nature and the place of forests in the evolution and progress of human society. And so it was in the retirement of forests that the great seekers of Truth found the Truth and sang and spoke about it till it has come down to India's present generation through the sacred books of the country.

Today, however, forests have ceased to have any spiritual inspiration or messages. They are the means of our physical welfare through their effect on climate, agriculture and industry. But even in that role man has not permitted forests to play their part. Almost in every country and more so in the countries of the East there has been a progressive denudation of forests and to that extent our soil has lost its natural guardian. The erosion of topsoil has become a grave danger to agricultural production to meet the ends of a growing population. Half the population of the world crowds upon the fields of Asia and more and more of the forest area is encroached upon to enable man to feed himself. The soil thus becomes more and more subject to erosion. To nations of Asia and the Pacific even a country like the United States holds up the finger of warning. I feel justified in taking a minute or two more of your time in repeating to you the verdict of that country's own Government on the menacing situation which confronts it. The United States has a billion acres under crops and pasture. An official report indicates that considerably more than one quarter of that billion acres have now been ruined or severely impoverished and that the remainder are damaged in varying degrees. Here are the very words of the report: 'The loss we sustain by this continuing erosion is staggering. Careful estimates based on actual measurements indicate that soil losses by erosion from all lands in the United States total 54,00,000,000 tons annually. From farm lands alone annual loss is about three billion tons, enough to fill a freight train which would girdle the globe 18 times. If these losses were to go on unchecked, results would be tragic for America and for the world.

'The results would not only be disastrous, they already are far too costly for the country to continue to bear. For example, in a normal production year erosion by wind and water removes 21 times as much plant food from the soil as is removed in the crops sold of this land. It is plain that farm lands which have lost so much topsoil and plant nutrients cannot produce as bountifully as they did before they were slashed and impoverished by erosion. In that fact lies the significance of America's erosion problem for America's

*Inaugural address by the Hon'ble Shri Jairamdas Daulatram at International Forestry Conference at Mysore.

citizens. We do not have too much good croplands available for production of our essential food and fibre crops in the future. If we do not protect what we have and rebuild the land which can still be restored for productive use, the time inevitably will come—as it already has come to some areas of the world—when the United States farm lands cannot produce enough for us and our descendants to eat and to wear'.

Our Conference has a large agenda before it. Many of these items are of a technical character: none of these is unimportant. And yet the overshadowing character of the basic problem of soil conservation and its integral relationship to a sound forest policy gives a challenge to us which we cannot afford to ignore. That a country so advanced in agricultural science, equipment and methods should have before it such anxious future is a call to the thickly populated nations of the East to think, plan and act betimes with prudence and promptness and reorient the national forest policy to meet the urgent needs of the situation. In our own country the problem is no less grave than anywhere else and it needs to be handled on a rational basis and with maximum coordination with Provinces and States. I realize that in India as elsewhere this cannot be a short term programme. Our country has resolved to achieve freedom from imports of foodgrains by the end of 1951. The provinces and States are being approached to join in attaining this objective of supreme national importance urgently. Though we are planning to concentrate on intensive cultivation with better use of water, manure and seed, it would be unwise not to design a national programme of soil conservation for simultaneous implementation.

You who are gathered together here are men of experience and learning and I would welcome it as a matter of fruitful result of the Conference if your decisions laid full emphasis on the framing of urgent plans for a rational integration of forest and agricultural policy so as to save our soil from progressive impoverishment.

Many of the other aspects of forestry are to receive your consideration during the days your Conference would be in session. Problems relating to industrial use of forest resources and the many special problems arising out of this are to be tackled by you; also, the great and the basic problem of protection and development of forest resources. Other immediate problems relating to fuel, wood, lumber and building material are also facing you. You are best able to decide how to deal with them. As a layman, I can only place before you a guiding consideration which in my humble view should inspire your deliberations and shape your decisions.

Forests can serve the cities and should serve, but it may be a proper and wise policy to let the forests serve primarily the vast rural area in which nature has set them. The vast masses of Asia and the Pacific live predominantly in the villages. Nowhere is the slogan of freedom from want more potent than in the villages and the limitless potentialities of our forest wealth should be tapped to raise the standard of living of our rural masses. This needs to be done not only by developing rural industries based on forests but even in other ways which will link this up with the daily economic life of the agriculturist. No instance can be more striking from this point of view than the present position of fuel wood for the villager's home. Denied of proper facilities in this respect he encroaches upon the food which the land badly needs and uses the manure as fuel. He forces himself into the vicious circle of less manure and less yield.

An effective programme for rapid increase in fuel wood for the rural masses which can be reconsidered with a rational policy of forest development would be a blessing for the agriculturists in most Asiatic countries. Representatives at the Conference can be pooled to discover all useful varieties of quick-growing trees which can be used for fuel wood and save billions of tons of rich farmyard manure for the hungry under-fed fields. This is but one instance. You know better than me by what other variety of measures your work can subserve the welfare of the rural people. A positive passion for improving the lot of these masses would be the growing qualifications of those who have devoted their life to the study in laboratory and in sylvan wilds and have sought out the secrets which for man's benefit nature has embedded in the great forests of the East.

While I am laying this stress on the ruralization of forest research I would not wish the Conference to ignore the urgent calls of industry on the forest resources. These too have their

places in the national economy and have to receive a response and I have no doubt that you will chalk out a suitable line of action to meet the demands of industry which is finding that iron and steel and other requisites are none too easily available. But while deliberating upon the measures of services to the rural masses or city industries, the experts and specialists in forestry from the countries of Asia and the Pacific can only be coming closer to each other forgetting for the moment their distinct nationalities and bound together by the strong ties which common research for nature's secrets naturally create. The bond of science and the brotherhood in service bridge all international gulfs and create a sense of fellowship, a spirit of human kinship and a feeling of cultural identity which I feel is at the present moment even a great contribution of such international conferences than even the concrete economic result which must inevitably result from your deliberations. India is only too anxious to help in forging such cultural links. It was our Great Teacher and Leader, Mahatma Gandhi, who preached the identity of man, whatever be his colour or creed and it is in that spirit that India should and would participate in conferences like yours of today.

It is probably true that in the particular field of forest research India has some advantage over some other countries in Asia. The results of about a century's research are available in its institutes and in its programmes of work which have been in operation for many decades. All these are at the service of our sister nations of Asia and the Pacific. We all welcome to our institutes and museums the scholars from our sister countries and give to them the benefit of all that nature or man's endeavour has made available to us. Treat our scientific possessions as your own. Knowledge can really be the possession of none.

Original Articles

THE USE OF COWS FOR WORK

IN various parts of the country recently acute shortage of bullocks has been felt. According to the 1945 census, the number of working animals had decreased in almost all the provinces. The shortage of bullock power, which was accentuated during the war due to greater pressure being placed on bullock transport in the towns, is likely to continue, specially in areas where famine has taken a heavy toll of cattle wealth.

Shortage of bullocks

At present, fodder famine is prevailing in Saurashtra, Gujerat and Kutch in an acute form. In these places large number of bullocks have died and to meet the normal agricultural requirements of those areas, bullocks are required in thousands. But as there is no surplus in the other parts of the country, this shortage cannot be met by indenting animals from elsewhere. The East Punjab, the United Provinces and Rajasthan which have usually a surplus stock in normal times, are also feeling the dearth of work animals. There will also be greater need for bullocks, in spite of the initial use of machinery, for the land that is to be reclaimed for increasing the food production of the country so as to make it self-sufficient by 1951. No doubt one way of overcoming this shortage is to accelerate mechanization, but machinery is neither easily available, nor can it be profitably used by the ordinary cultivator, whose holdings are usually very small and more often scattered.

Working of cows in Egypt

Obviously, the solution must be found within the present agricultural set up. One way seems to be the use of cows for work. During his recent visit to Egypt, Sardar Datar Singh, Vice-Chairman of the Indian Council of Agricultural Research, observed that it was a common practice there to use cows for carrying out field operations as well as for other types of draught work. Working of the cows neither had any ill-effect on the milk yield of animals nor on their health. Not only were the animals in milk worked, but even dry animals up to two months before calving were used in this way. This practice helped the Egyptian farmer to economize on the feeding cost to a considerable extent because it involved the use of a lesser number of bullocks.

Mahatma's blessings

It was considered desirable that this idea should be seriously taken up in our country, where there is an acute shortage of both fodder and bullock power. The draught quality in Indian cattle breeds has been established beyond reasonable doubt and there appears to be no reason why cows should not be put to work for the benefit of the cattle-owners, as well as the cattle themselves. But because of the sanctity and veneration attached to the cow in this country, the problem was brought to the notice of Mahatma Gandhi to ascertain if there was anything objectionable in working the cows. He gave his blessings to the idea of working the cows, because of its economic advantage to the poor cultivator and indirect beneficial effect on the animal. The Indian Council of Agricultural Research accordingly decided to test the working of cows on Government farms. A scheme was, therefore, sanctioned to test cows at four centres on some of the recognized breeds of cattle, and the work has been initiated at the Indian Dairy Research Institute, Bangalore, on Sindhi cows and at the Government Livestock Farms in Mysore State on Amrit Mahal and Hallikar breeds of cattle.

Prevailing practice

It may also be mentioned here, for the benefit of those who may have aversion for

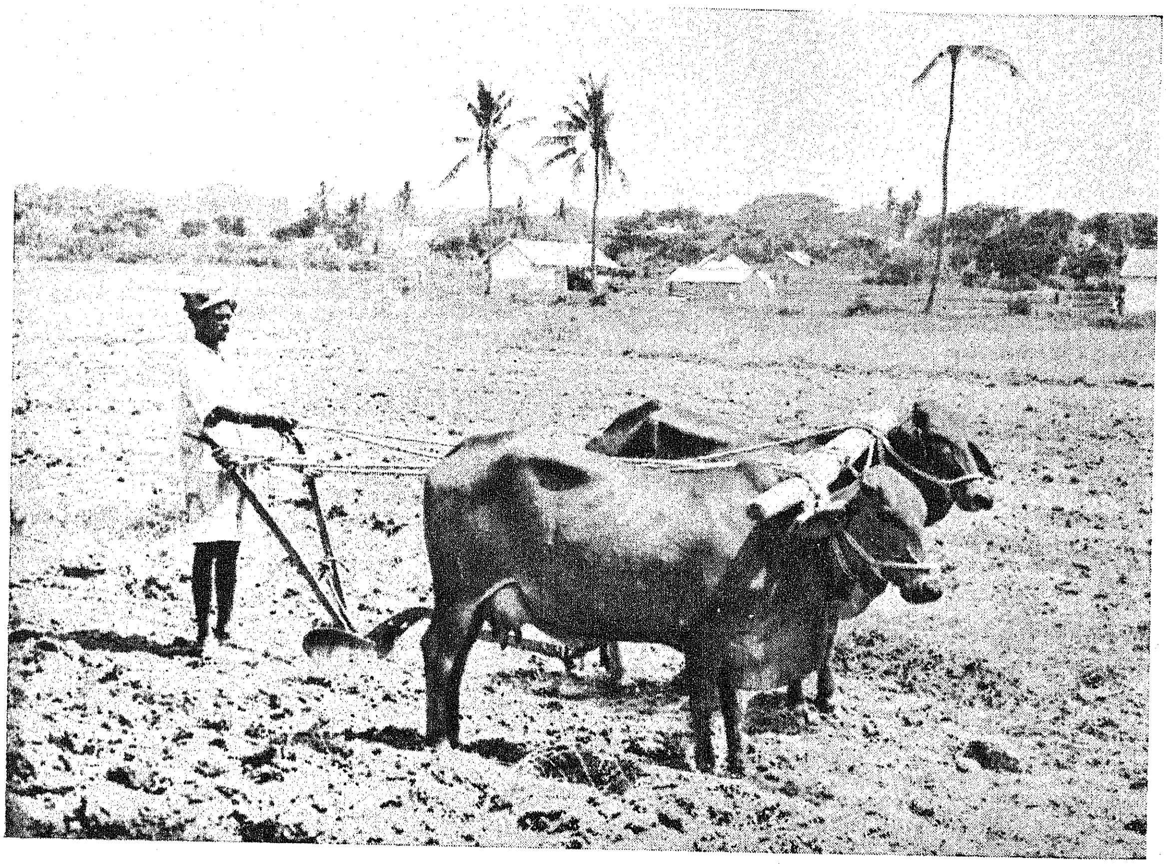
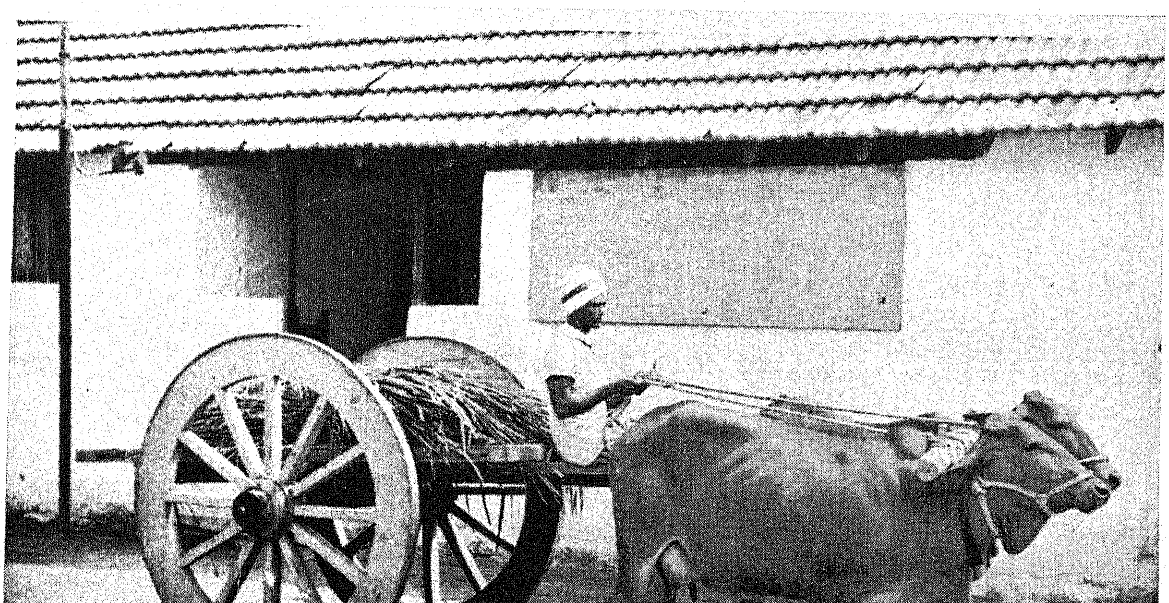


FIG. 1. Sindhi cows ploughing the field

FIG. 2. Sindhi cows in light cart work



or prejudice against the use of the cow for work, that the idea is not altogether new to this country. The cow has been used in the past and is still being used under the yoke in Mysore and Coorg; and Dhani cows in the West Punjab were used to a considerable extent for work. To make full and proper use of our animals, not only the uneconomic cattle should be put to work, but also the others whose utility should be increased by putting them to work and by better feeding and looking after.

Training of cows for work

The period of training for draught work is a particularly trying one, for much more energy is expended by the animals during this time than later when it has become accustomed to the work. When it is decided to train a cow or a heifer, it should be quietly, but as quickly as possible, broken to draught and paired with another cow. The work allotted should be normal road draught work about the farm or the cultivation of normal arable land for six hours each day on all working days. Work should not be demanded within two months of calving and till one month after.

Food requirements

The working cow must be given sufficient food to meet her requirements of maintenance, work and milk, in addition to sufficient minerals and vitamins. The ration however should not consist of more than 2·5 lb. of dry matter per 100 lb. of body weight of the cow or, if possible, even less for it is only very good cows that are able to consume so much. At the most 15 lb. of dry matter is what a normal 600 lb. cow can eat and digest. As the power to consume is limited, a normal 600 lb. cow cannot be expected to give more than 10 lb. of milk per day while working and this target can be achieved only if the maximum amount of concentrates are fed. The daily requirements will thus be 20 lb. of grass and 10 lb. of concentrates. This will provide sufficient energy for maintenance, six hours of medium type of work, five seers of milk containing 5 per cent butter fat and also leave a small surplus.

The guiding principle in feeding a working milch cow is exactly the same as that for feeding a non-working dairy cow, i.e. that the food should be increased in anticipation of increased output until no response to the increased diet is evoked.

Economics

At the price of Rs. 2-8 per maund for grass and Rs. 10 per maund for concentrates, the daily ration of a 600 lb. working cow, should cost about Rs. 1-14 or say Rs. 2, of which a quarter or eight annas per diem will be on account of work. This obviously is cheaper than maintaining a separate animal for work only.

It will thus be observed that by using cows for work, it will not only be possible to overcome bullock shortage, but also to feed them better, because of the increased economic return obtained from them. The problem of fodder shortage will also be overcome to some extent because of the lesser number of animals required. Let the old prejudices therefore be cast away, which have arrested the progress and growth of agriculture and livestock in this country and converted our cattle into an uneconomic burden rather than an asset. It is only by getting rid of such prejudices that it will be possible to transform our livestock into more productive animals. This will also enable us to give them the attention they deserve, otherwise our *ahimsa* or reverence for the cow would merely be an idle talk. (H.K.L.)

SWEET POTATO

By B. SEN

SWEET POTATO though sweet is not a potato at all. The ordinary potato belongs to the botanical family of Solanceae, and the sweet potato (*Ipomoea batatas*) to the family of Convolvulaceae. Moreover, potato is a modified shoot, whereas sweet potato is an enlarged root. Both, however, are excellent sources of human food. It is not generally recognized that sweet potato contains a higher percentage of carbohydrates, calcium and vitamin A than ordinary potato. In India, for some unknown reason, sweet potato is generally looked upon as an inferior food crop. In spite of the fact that sweet potato can help in a great measure to relieve our acute shortage of both food and fodder, up to this time it has not attracted the attention it deserves.

It was during my visit to the U.S.A. in 1946-47 that Mr. Glen Overton of Dowagiac, Michigan, first brought to my notice the practical possibilities of increasing food production in India by widespread cultivation of sweet potato. As a result of subsequent visits to the laboratories of Dr Julian C. Miller at Baton Rouge, Louisiana, and of Dr C. E. Steinbauer at Beltsville, Maryland, I became convinced of the tremendous importance of the sweet potato crop for India. Through the courtesy of the gentlemen referred to above I was given seeds and roots of several high yielding and disease-resistant strains of sweet potato recently evolved in the United States.

For even in the U.S.A., the increased interest in sweet potato is of comparatively recent origin. It was the demand of the Army for dehydrated food during World War II, and stoppage of normal imports from abroad of root starch (which America makes use of to the extent of hundreds of millions of pounds annually) that brought out the importance of sweet potato in the U.S.A. By 1945, the total value of the U.S.A. sweet potato had reached the staggering figure of approximately Rs. 44 crores a year.

Food

In February, 1941, a 5 lb. sample of dehydrated sweet potato was sent to the U.S. Army Quartermaster Corps. Immediately an order for a 2,000 lb. sample was placed. By 1942, the order for dehydrated sweet potato was 2,000,000 lb. In 1945, the U.S. Army and Lend-Lease requirements had risen to 20,000,000 lb.

Dr Miller gave me the following explanation: 'Probably no other vegetable crop carries so many nutritive units as does the sweet potato. Apart from sugarcane no other crop can produce an equal yield of carbohydrates per acre.'

Dr Miller's analysis of the comparative nutritive values of edible portions of potato and sweet potato is reproduced in Table I.

TABLE I

Composition of edible portions of potato and sweet potato per pound.

	Calories	Protein	Fat	Carbohydrate	Calcium	Phosphorus	Iron	Vitamin A	Thiamine	Riboflavin	Niacin	Ascorbic Acid
		gm.	gm.	gm.	gm.	mg.	mg.	Units	mg.	mg.	mg.	mg.
Sweet potatoes	567	8	3	127	159	222	3·2	17,200	0·45	0·32	5·9	113
Irish potatoes	386	9	0·5	87	36	222	3·4	180	0·41	0·23	5·4	45

B. SEN is Director, Vivekananda Laboratory, Almora, (United Provinces).

It will be seen from Table I that sweet potato ranks higher than ordinary

potato in most categories, particularly in carbohydrates, calcium and vitamin A. Moreover, the yield of sweet potato per acre has been found to be higher than that of ordinary potato. Tender end-lengths of sweet potato vines can also be used as a table spinach. A few plants would be sufficient to supply spinach requirements of a family, provided they can be watered during the summer months.

Sweet potato flour

Small samples of sweet potatoes can be sun-dried by the cultivators and made into flour for their own use, as is now commonly done in villages in India where sweet potatoes are cultivated. For handling large quantities of sweet potatoes, modern dehydrating machines can be utilized with profit. There are several machines, made in the U.S.A., specially adapted for dehydrating sweet potatoes. They can also be used for speedy drying of sweet potato tops (stems and leaves) for fodder. Experimental trials in India have shown that 20 per cent of sweet potato flour, or even more, can be mixed with *atta* for *chappatis*. The result is both nutritious and palatable.

Fodder

Apart from the higher yield of the edible roots of sweet potato, as compared with ordinary potato, the vine terminals and leaves constitute an excellent source of fodder. Nearly 1¼ tons of high quality dehydrated sweet potato leaf meal can be obtained per acre. The feed value is approximately equal to that of alfalfa hay, as will be seen from the unpublished data of Dr Julian C. Miller in Table II.

TABLE II

Feed values of sweet potato leaves and terminals and alfalfa hay

	Protein	Fats	Carbohydrates	Mineral matter
	(All given in percentages)			
Sweet potato leaves and terminals ...	12·6	3·3	45·5	10·2
Alfalfa hay ...	14·7	2·0	36·4	8·3

Thus the roots and tender vine end-lengths of sweet potato offer a very nutritious food for human beings, and the stringy roots and stems and leaves make an excellent fodder for cattle.

Sweet potato also has a number of important industrial uses.

Starch

Sweet potato starch has been found equal, if not superior, to other root starches for the manufacture of certain adhesives, laundry starch of high quality, textile and paper sizings and for use in the cosmetics, baking and confectionery industries. The percentage of starch in sweet potato has been found to vary from 19 to 32 per cent, according to the strains, climatic conditions of the region, and the date of planting and harvesting. The strain known as Pelican Processor evolved in Dr Miller's laboratory at Baton Rouge produced at the Louisiana State University Experiment Station a record yield of 780 bushels (42,900 lb.) per acre ! This strain is a starch variety and its starch content varies from 26 to 32 per cent depending on the soil and season. It has also the lowest moisture content. Type B-196 has also been found to be a very high yielder and it has the further advantage of being resistant to stem rot.

Industrial alcohol

The grades of sweet potato not suitable for food can be utilized for the production of industrial alcohol. A bushel of dehydrated Pelican Processor sweet potato has been found to yield 5·44 proof gallons of alcohol.

Pectin

Sweet potato is rich in pectin, which is used for the manufacture of marmalades and jellies.

Carotene

Carotene is one of the principal sources of pro-vitamin A and is in great demand for fortifying foods. Some of the strains of sweet potato can produce as much carotene per pound as carrots. When sweet potatoes are used for manufacture of industrial alcohol, carotene is obtained as a by-product.

Syrup

Syrup can be very easily produced from Nancy Hall sweet potato, and in India could form a cottage industry, allied to the making of indigenous sweets. The sucrose content of the syrup is only 7 per cent and the syrup is not so sweet as cane-sugar syrup, but it can easily be blended by addition of say 10 per cent of cane-sugar syrup. Dr G. A. Shuey's analysis of sweet potato syrup is given below:

TABLE III

Analysis of sweet potato syrup

Water	... ...	30·12 per cent
Ash	... ...	1·75 „ „
Protein	... ...	2·45 „ „
Maltose	... ...	43·01 „ „
Sucrose	... ...	7·00 „ „
Dextrins	...	14·04 „ „
Undetermined	...	1·63 „ „

Grading of sweet potatoes

Sweet potato plants produce roots of various shapes and sizes. In the U.S.A. grades for table use have been standardized. For Grade No. 1, the diameter should be from $1\frac{3}{4}$ to $3\frac{1}{2}$ in. and length from 3 in. to 10 in. For No. 2, the diameter should measure not less than $1\frac{1}{2}$ in. nor more than 4 in. The very small roots, as also the very large over-sized roots called 'Jumbo', not convenient units for cooking, are utilized for dehydration or other industrial purposes. The stringy roots are utilized for cattle feed. Thus absolutely nothing is wasted.

Storage of sweet potato

Care must be taken to prevent cutting, bruising or otherwise injuring the sweet potatoes during harvesting or subsequent handling for market. Otherwise the loss during storage becomes a serious problem. For instance, it was found that the loss from uninjured sweet potatoes stored for $5\frac{1}{2}$ months was 13·8 per cent due to shrinkage and less than 1 per cent from rots, while the loss from the injured roots was 28·1 per cent by shrinkage and 13·8 per cent from decay. Since it is through any break in the skin of the roots that diseases get started, the sweet potatoes after harvesting should be subjected to conditions which close the wounds effectively by the formation of a wound cork-layer. This process is called curing. Freshly harvested sweet potatoes should preferably be kept for 10 to 14 days at 80°F. to 85°F. with a relative high humidity of 85 to 90 per cent. Afterwards the cured sweet potatoes are best stored at a temperature of 50°F. to 55°F.

Cultivation of sweet potato

Sweet potato grows best in regions of light sandy or silt loam, with a growing period of four months during which warm nights prevail. According to the fertility of the soil, 5 to 6 maunds of 4-12-4 (N-P-K) of commercial fertilizer or its equivalent is recommended to produce a good yield. Green manuring has also been found to improve the crop. For sweet potato cultivation, at least a three-year rotation is recommended.

Healthy sweet potato roots are allowed to germinate in nursery beds and when the sprouts reach 5 to 6 leaf-stage, they are pulled out and planted in the fields. These are called 'draws'. From the same root second and third sets of draws can be obtained at intervals of two to three weeks. Dr Miller, however, favours propagation of plants from vine cuttings, since a greater number of vine cuttings than 'draws' from the seed roots can be obtained and the risk of infection is also minimized.

From the results of coordinated experimental work carried out by the U. S. Department of Agriculture in different regions with many strains of sweet potato over a period of several years, the general cultural practices recommended for higher yield and better quality of sweet potato roots are: early planting in ridges one foot high and four feet apart, with plants 12 inches apart in the row.

Preliminary experiments in Almora, U.P. with U.S.A. sweet potatoes

Two roots each of 13 strains of sweet potato received from the U. S. Department of Agriculture, and seeds of one strain obtained from Dr Miller were planted in Almora on 21 March, 1948. Roots of two strains of Bengal sweet potato and cuttings of two strains of Bombay sweet potato were also

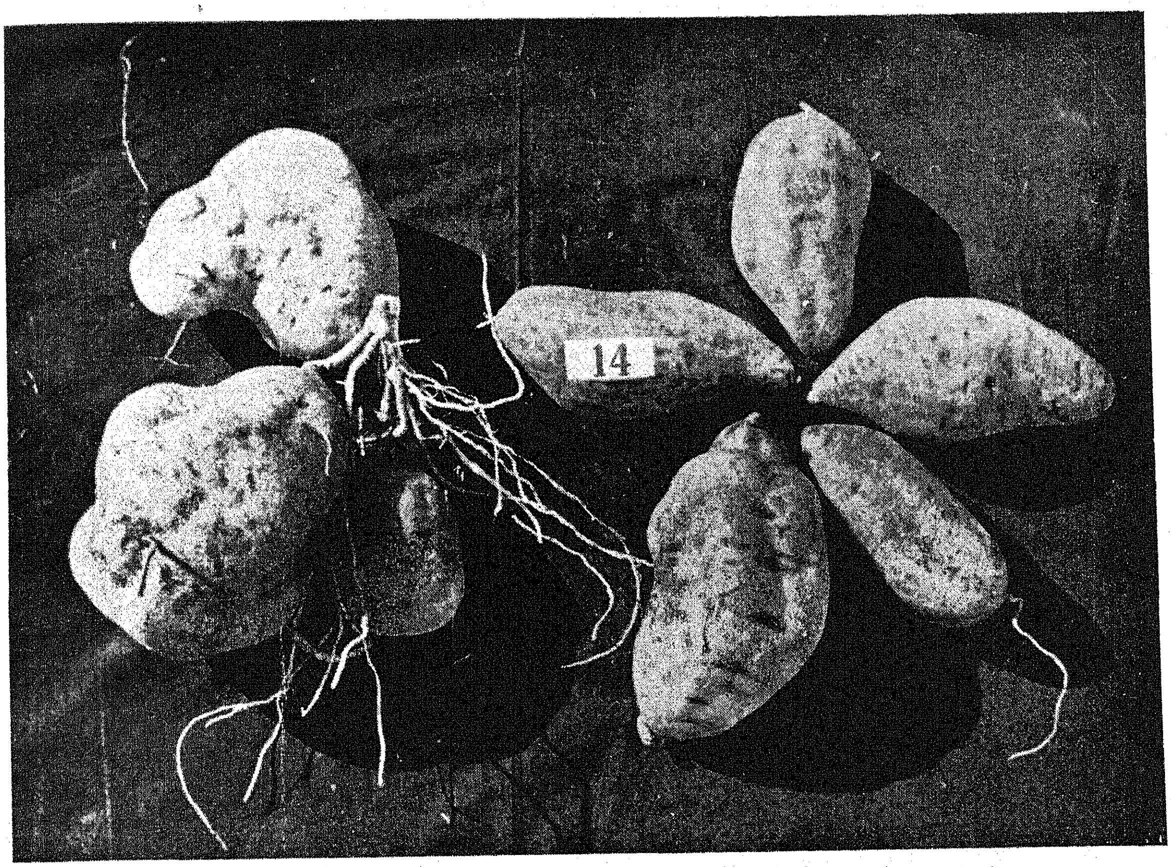
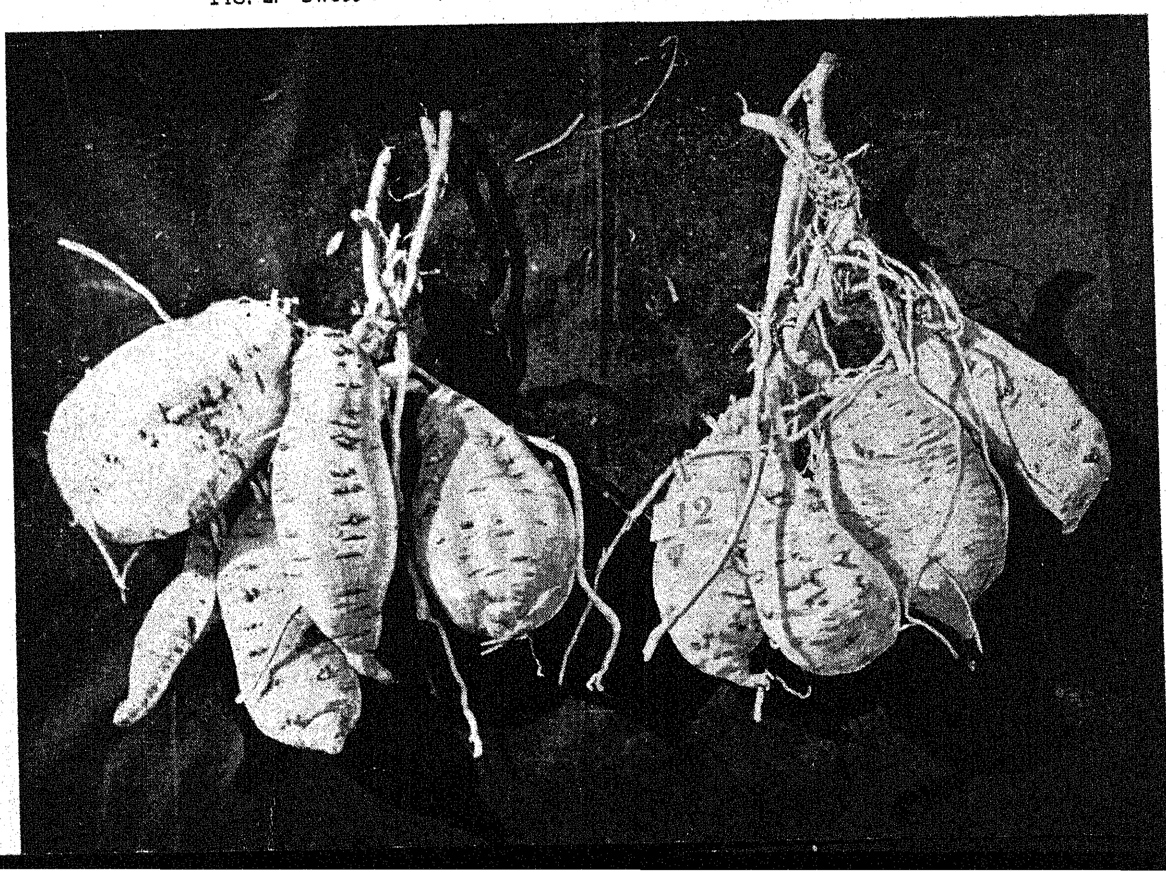


FIG. 1. Sweet Potato, Bengal White—high yielder with highest water content

FIG. 2. Sweet Potato, Pelican Process, U. S. A. strain—starch variety



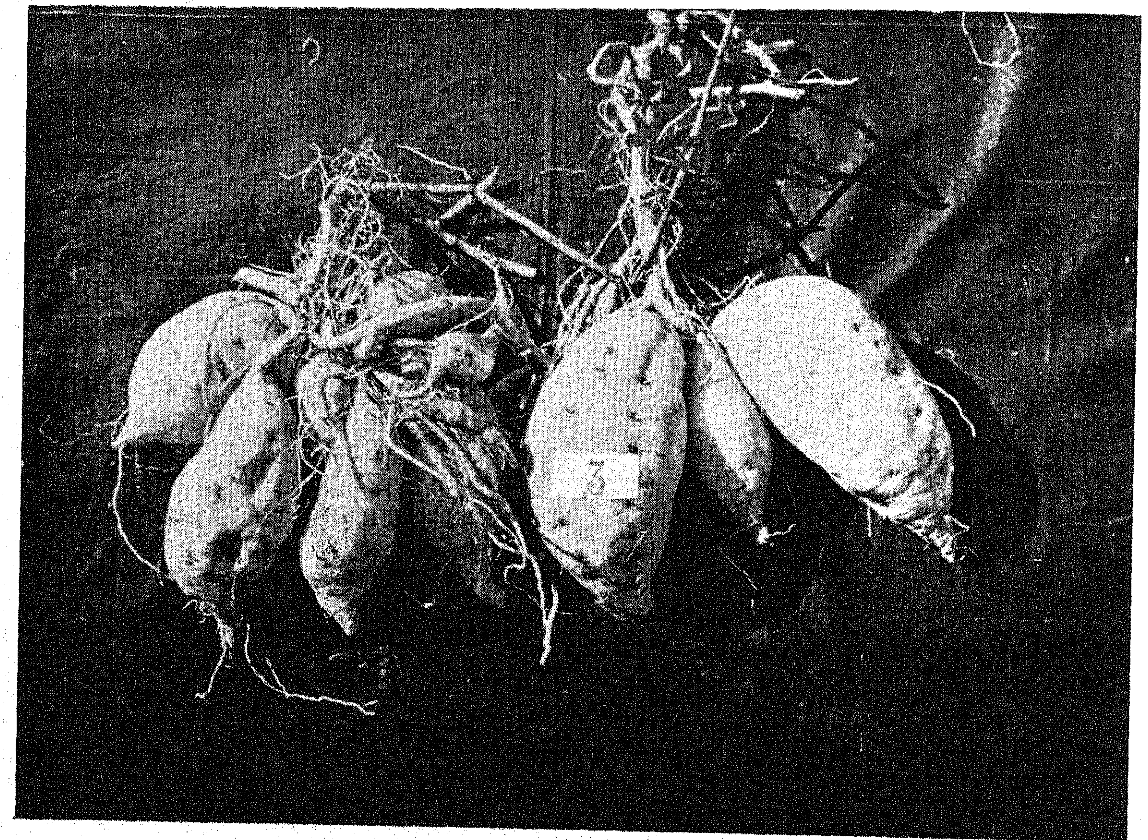
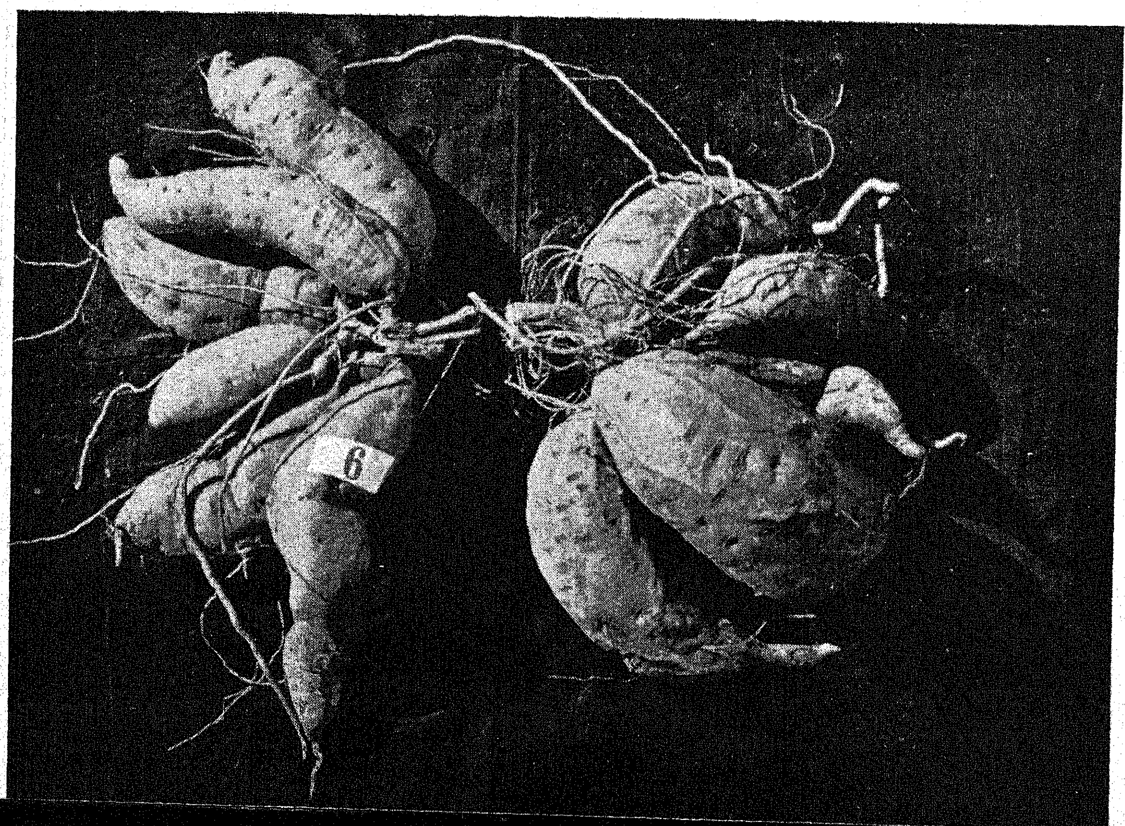


FIG. 3. Sweet Potato, Triumph, U. S. A. strain—starch variety

FIG. 4. Sweet Potato, B-219, U. S. A. strain—starch variety



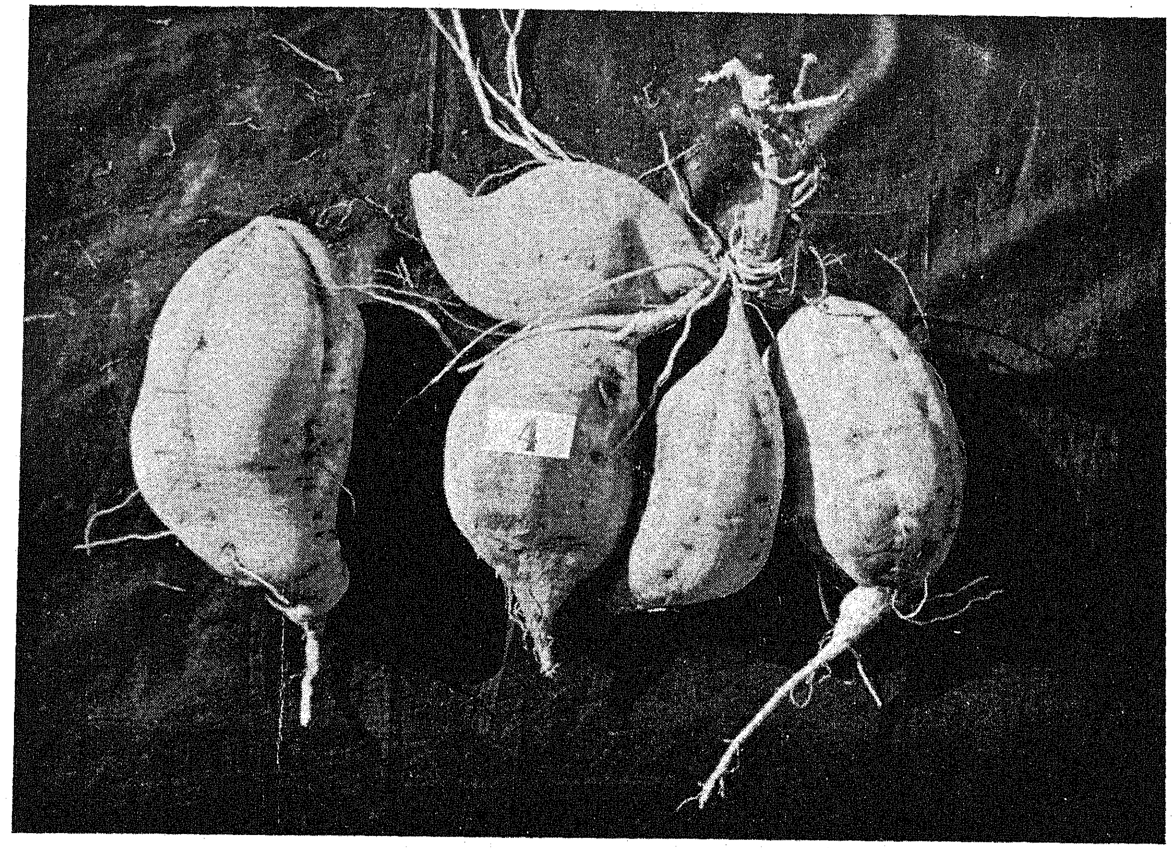


FIG. 5. Sweet Potato, Ranger, U. S. A. strain—high carotene content

FIG. 6. Sweet Potato, Nancy Hall, U. S. A. strain—high carotene content

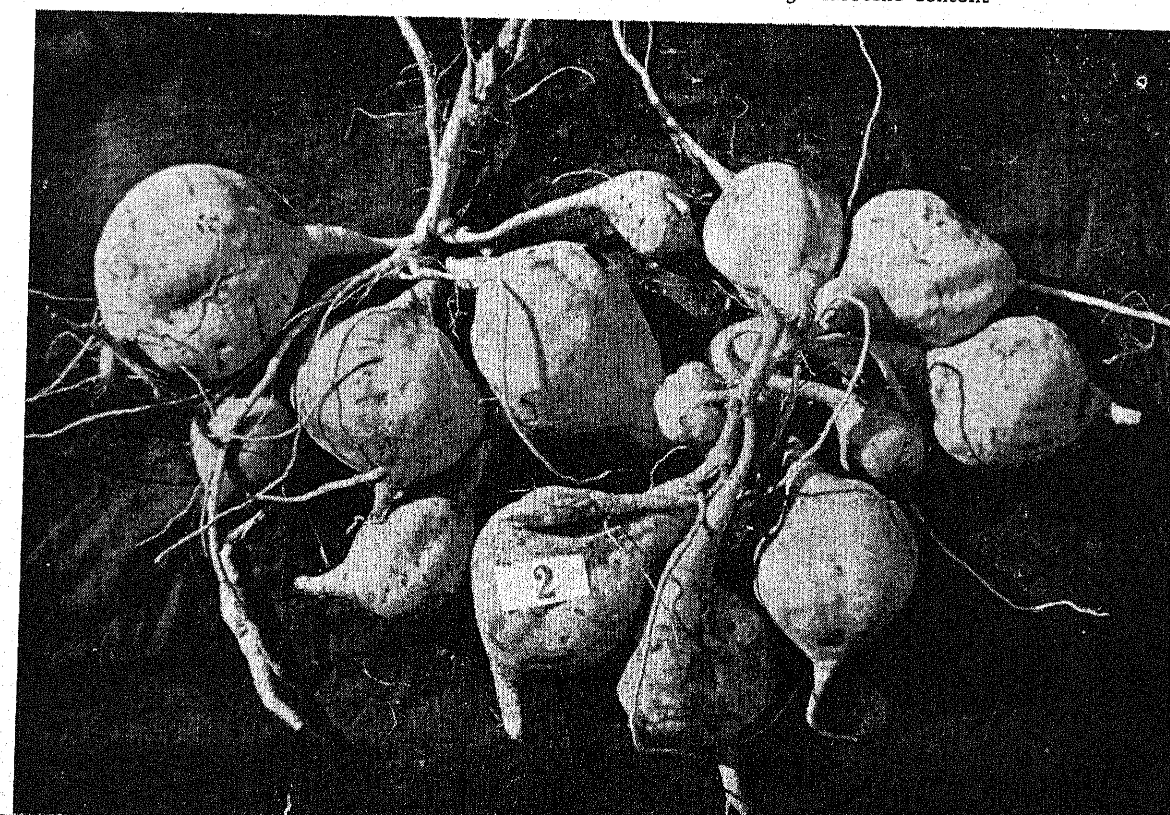


PLATE 37

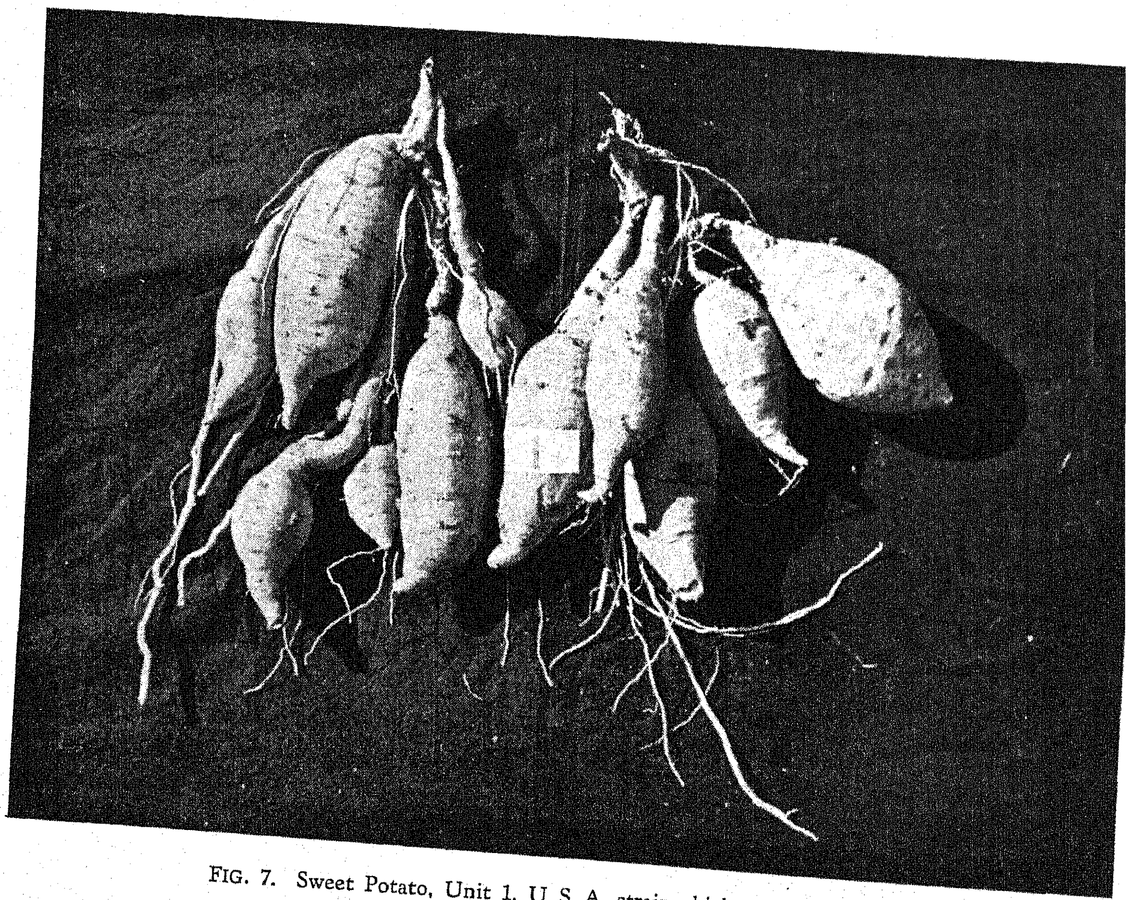


FIG. 7. Sweet Potato, Unit 1, U. S. A. strain—high carotene conten

obtained for comparative trial. On account of the limited area of our experimental plots and the varying number of cuttings of each strain available at any sowing date, a properly replicated experiment could not be undertaken in 1948. Sowings in the experimental plots were continued from 1 May to 26 June, 1948. Each strain was planted in a separate plot—10 ft. × 10 ft. The distance between the rows was 3 ft. and between plants 12 in. For root multiplication, a very late sowing was undertaken on 8 July, 1948 at the U.P. Government Farm at Hawalbagh. The weights of the roots and of the tops (vines and leaves) of each row were recorded at harvest time. From the nature of these two preliminary experiments no conclusive estimate of the comparative yield of the different strains would be justified. But the general claims of sweet potato summarized above seem to be amply justified.

(a) Compared to the yield of the ordinary potato, the yield of sweet potato is much higher. For instance, in a sowing of February, 1948, of several strains of U.S.A. ordinary potatoes, the highest yield, calculated on an acreage basis, was of the order of 220 maunds from the strain Essex. On the other hand, the highest yield of sweet potato was of the order of 435 maunds from the Bengal White variety and 388 maunds from U.S.A. Nancy Hall, as will be seen from Table III. (Photographs of roots of some of the strains are given in Plates 34–37. Obviously, the yield figures given in Table III are not likely to be obtained by the cultivators, until adequate facilities become available for improving their cultural practices. Under similar cultural conditions, however, not only will the yield of the more nutritious sweet potato be higher than that of ordinary potato, but the supply of much needed fodder will be an additional gain.

(b) The fresh weights of the tops of different strains of sweet potatoes as indicated in Table III show that it might even pay us to grow sweet potato on a large scale for fodder alone.

(c) From the records of the yields of roots from rows planted at different dates, it was found that the yields from the first rows of the different strains were invariably higher than those from the latest plantings of the cuttings in the third rows. The yields of Orange Little Stem and of B-4306, planted on 25 June, and of M.4 planted on 6 July, was poor, and yields of all strains planted at Hawalbagh on 8 July were much lower compared to the yields obtained from the earlier sowings in Almora (Table III).

TABLE III

Showing yield, calculated on acreage basis, of roots and tops of different strains of sweet potato observed in Almora and Hawalbagh

Strain	Roots		Tops	
	Almora (Maunds)	Hawalbagh (Maunds)	Almora (Maunds)	Hawalbagh (Maunds)
Unit I ...	148	121	494	346
Nancy Hall ...	388	119	180	318
Triumph ...	347	120	268	166
Ranger ...	302	112	501	166
B-196 ...	291	208	451	194
B-219 ...	322	82	400	304
B-4004 ...	294	214	440	97
B-4306 ...	79	52	509	581
B-5941 ...	313	...	175	...
Yellow Jersey ...	235	113	196	137
Jersey Bigstem ...	289	92	324	28
Pelican Processor ...	289	...	201	...
Orange Litte Stems	99	...	...	...
Bengal White ...	436	201	345	180
M.4 ...	126	...	319	...
Bengal Purple ...	301	...	411	...

To find out the strains best suited for any given region, properly planned coordinated sowings should be undertaken in different regions with all available strains of sweet potato both Indian and foreign. This is essential because the yield and the quality of the produce will depend, under otherwise similar cultural conditions, not only on the strain but also on the climatic factors of the region. From a series of plantings at different dates, the best sowing date for a particular region has to be determined. It will be necessary for each province to establish a central station where chemical analysis of roots can be systematically carried out, to determine the content of carbohydrate, calcium and pro-vitamins. For instance, in Almora the Bengal White variety gave the highest yield, while in Hawalbagh the U.S.A. strains, B-4004 and B-196, both gave higher

yields than Bengal White. On the other hand, we found that the moisture content of roots of Bengal White was very high, about 83 per cent, while that of Nancy Hall was 69 per cent and of Triumph, 63 per cent. Computed on the basis of solids, the yield of Bengal White was 74·46 maunds compared to 120·28 maunds for Nancy Hall and 128 maunds for Triumph per acre.

Along with agronomical studies, there should be a comprehensive research programme for breeding still better strains of sweet potatoes suited to Indian climatic conditions. In the U.S.A. most of the improvements of sweet potato have been confined to the selection and propagation of the outstanding mutations, since most of the sweet potatoes do not normally flower in the U.S.A. climate. By overwintering and girdling, Dr Miller has been able to carry out his programme of sweet potato breeding. In India, we are likely to find areas where the different strains of sweet potatoes would normally flower and thus facilitate the breeding work.

In view of our shortage of both food and fodder, we should not be taking any risks in intensifying the cultivation of sweet potato all over the country during the coming year. Furthermore, sweet potato grows extremely well in newly reclaimed land, and therefore in our vast reclamation programme its cultivation should be given the emphasis it deserves.

It is a pleasure to acknowledge the enthusiasm and help of all members of the staff in our first work with sweet potatoes at this Laboratory, particularly of Shri Tara Datt Pant in the supervision of the field work and of Shri Shankar Lal Sah, in the despatch of over 32,000 vine cuttings sent on request to the different Provinces. The financial aid received from Shri Charat Ram, New Delhi, has enabled me to meet the expenses of this preliminary work with sweet potato.

Note: The sizes of the different strains of sweet potatoes reproduced in the plates are strictly comparable.

VEGETABLE SEED PRODUCTION IN THE KULU VALLEY

By SWARN SINGH PUREWAL

ONE of the primary requisites for success in vegetable growing is the use of good seed and for increasing the production of vegetables the most essential thing is a dependable source of seed supply. In the past in the absence of organized vegetable seed breeding stations and seed control laws in this country, the seed supply could not be altogether regulated. Unless and until vegetable seed production is planned and organized on a scientific basis, vegetable growing, and especially increased production, cannot be placed on a sound footing. In the matter of imported seeds, however, this country was afforded a golden opportunity during the World War II to develop its own seed industry when due to transportation and other difficulties, the imports of seeds became altogether impossible. The Agricultural Production Adviser and his staff in the Ministry of Agriculture, Government of India, seized this opportunity and did much to organize seed production in Quetta and Kashmir, but as a result of partition, Quetta is no longer in the Indian Union and in Kashmir, the production has been totally dislocated as a result of disturbances. At the present time, therefore, we are faced with the difficulty of finding alternative sites and utilizing these for vegetable seed production.

For the successful production of seeds of European varieties of vegetables such as cabbage, turnip, etc. the root cuttings or mature plants, as the case may be, after transplanting are required to be exposed to a low temperature of 40°F. or lower for a period of one month or more (January-February) coupled with dry and cool conditions at transplanting time (November-December), warm and dry season at harvest time (May-June) and moist and comparatively cool climate during the growing period (July-October). Requisite climatic conditions for the production of these seeds obtain in the Kulu valley which can be seen by reference to the meteorological data in Table I collected at Katrain.

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TABLE I

Averages of meteorological data for the last three years (1945-47) *recorded at Katrain*

Month		Maximum temperature °F.	Minimum temperature °F.	Rainfall in.	Remarks
January	...	51·6	33·3	3·2	
February	...	58·6	36·3	2·6	
March	...	64·6	43·3	5·6	
April	...	77·6	47·3	2·6	
May	...	83·3	53·3	2·2	
June	...	87·0	59·6	2·9	
July	...	84·3	65·0	6·2	
August	...	82·0	69·0	6·8	
September	...	77·0	62·0	8·7	
October	...	72·2	46·3	2·4	
November	...	65·0	38·6	0·5	Rainfall in 1946 only.
December	...	54·3	43·0	3·0	
				45·5	

At the instance of the Indian Council of Agricultural Research, New Delhi, and realizing the need of the time, the writer in 1942, when European imports of seeds were impossible, started the work of vegetable seed production at Katrain (Kulu valley) at an altitude of about 4,800 ft.

The first two seasons were spent on experiments for ascertaining the optimum time of

sowing these crops for seed production and in the development of proper technique of combating insect pests, harvesting and curing of seeds. Now for the last four years these seeds have been commercially grown on our farms with considerable economic returns and for meeting the needs of the growers in the plains of the Punjab. As a result of changed conditions, the Kulu valley has assumed great importance for seed production work. It is, therefore, deemed desirable to publish such information as is available on the subject to serve as a practical guide to those who want to take up commercial seed production there.

Methods of production

Seed production is an exacting work, which requires technical knowledge of plant breeding and of growing of seed crops, of curing and handling seed and of prevention of crossing in the field. For the production of pure seeds, the selection of suitable stocks and isolation of the seed plots to prevent crossing is the most important. Some of the vegetable crops such as peas and beans are normally self-pollinated and their different varieties may be grown close together without any danger of crossing. Others such as cabbage, cauliflower, kohl-rabi, turnip, radish, beet, etc. are cross-pollinated and their varieties and closely related species need to be segregated. The crops belonging to the *Brassica* group readily cross with each other if they happen to be in blossom at the same time. Therefore, for the production of seed, these need to be completely isolated if several of the varieties are to be grown or if several of the Brassicas are to be grown. The distances necessary to separate varieties depend on the mode of pollination, i.e. whether it is effected by wind or insects.

In case sufficient land is not available, the difficulty may be overcome by growing not more than one variety of any of these crops at one place. In the Kulu valley, the writer had found the solution of the problem by utilizing plots with a distance of two or three miles between them. Of course, there was the advantage that nobody else was growing these crops there for the purpose of seed production thus precluding any chances of cross-fertilization.

The soil of the Kulu valley especially in Behal (along the River bed) is rather poor. Therefore, for obtaining good yields, it is necessary to manure the soil copiously with farm-yard manure. The minimum quantities of manure to be applied should not be less than 600 maunds per acre. Ample use of ammonium sulphate is also desirable when the plants are growing vegetatively, as well as at the time when stalk formation starts, i.e. in spring when new growth takes place. At least three maunds of ammonium sulphate should be applied in two dozes when the crop is growing vegetatively and another maund or so in spring at the time of the seed stalk-formation; the latter makes the seed plump. Seed crop production is not possible under *barani* (rain fed) conditions and should not be attempted.

Cabbage

The seed is sown in the seed bed for the production of seedlings from the fourth week of June to the middle of July; half a pound of seed is sown to produce seedlings for one acre. The seedlings are ready for transplanting in three to four weeks after sowing. The plants are transplanted in rows 1½ ft. apart and plants 18 in. asunder. They are grown in the fields till the end of November with regular cultural operations. In November, when the plants are full-grown, every other row is removed and the desirable plants from the uprooted ones are used for filling in the gaps resulting from mortality and roguing operations in the remaining rows. The good plants surplus to the need may be transplanted in a separate plot. Roguing is very essential for the removal of the off-type plants as well as those forming loose heads. Finally, the distance between the rows of plants is 3 ft. The plants are earthed up in December to cover the stems before it starts snowing during January-February. In March the sprouting begins which is indicated by the early bulging of the heads. To facilitate sprouting, a cross-wise cut is given to each head taking care that the sprout is not injured. This cut helps the sprouts in coming out quickly, straight and in the centre; otherwise sometimes the sprouts come out on the side and grow on the ground or fall on the side. As soon as the sprouting begins by the onset of warm weather, the insect fauna also become active. The aphids make their appearance earliest,

followed by cabbage butterfly. The aphids are the most harmful of all the insects because they suck away juice of the pods and flowers causing them to wither. The aphids are controlled by spraying with 2 to 3 per cent soap solution or with tobacco decoction. Also hand-picking of insects sometimes is very essential; yellow clusters of butterfly eggs are easily detectable and picked off by hand. Insects must be controlled constantly till the maturity of the pods. As the pods begin to ripen, the side shoots usually fall on the ground because of the weight of the pods. In order to save the pods from damage due to falling, the side shoots are generally held up by means of stretching strings along the rows and tying the strings at the ends of the rows to stakes. If the rows are too long a few stakes are also driven in at intervals; this also prevents breaking of the strings. It is better, if the string is wound round two or three plants together here and there along the row; this keeps the plants fastened in the event of heavy winds.

Harvesting starts by the beginning of June. Early-ripened pods are detached by sickles from the parent plants lest they should be shattered. The whole field is thus covered to remove the early-ripening pods. As the green pods ripen, they are again removed and thrashed after two to three days. The main stem is left standing in the field and removed afterwards and burnt. The harvesting is completed by the middle of July. The average yield per acre is 200 lb.

Rotting of the heads takes place during spring due to soft rot. Therefore, provision for proper stand should be made by making thick plantings. Soft rot is a deadly fungal disease of young as well as head-stage plants and the plants affected should be removed immediately.

Turnip

The turnip seed at the rate of 2 lb. per acre is sown on the ridges 1½ ft. apart in the field for the production of roots from the second week to the end of August. The seed germinates three to four days after sowing. The thinning of the plants is done from time to time beginning after three weeks of sowing; the final distance from plant to plant should be 6 to 9 in. The roots are ready for transplanting by the beginning of November when they are dug out and typical healthy roots are selected for transplanting. The root cuttings are prepared by removing about one-third of the lower portion and trimming the leaves about 1 in. in length from the crown end. The root cuttings are planted in a well prepared field in rows 2 ft. apart and the plants in rows 1½ ft. to 2 ft. apart. The root cuttings are buried in the soil up to the crown end and as the seed stalks grow out, the plants are earthed up resulting in small ridges. No staking of the plants is done in this case.

The crop is ready for harvesting by the middle of May. As the pods ripen, the stalks are removed by sickles. The entire crop is removed by going over twice. The stalks after cutting are stored for two or three days and then thrashed by beating out the seed. The average yield per acre is about 180 to 200 lb.

The turnip is affected by root-rot disease which starts at the time of the formation of knobs and continues even in the transplanted roots, causing gaps in the raws. Some spare roots are usually kept to fill the gaps occurring shortly after transplanting say till the end of January.

The crop is heavily attacked by aphids and cabbage butterfly. The same control measures are practised as in the case of cabbage.

Some sort of malformation of the plants also occurs at the time of flowering as a result of which the plant remains altogether barren or partially barrén. This causes considerable reduction in the yield. All the varieties are equally affected by this disease.

Kohlirabi

The seed is sown in the nursery beds in the month of August and the transplanting of the seedlings is done by the middle of September in rows 2½ ft. apart, and the plants in rows 18 in. asunder. Regular cultural operations are performed and when the knobs begin to enlarge slight earthing up is done and off-type plants are rogued out. The seed stalks begin to emerge in the month of March as soon as the season warms up. Insect pests attack flower shoots and the most prominent ones are aphids and cabbage butterfly in the early stage and *Begrada picta* in the last stage of plant growth.

Aphids are controlled by spraying with soap solution with a small quantity of kerosene oil added to it. Cabbage butterfly lays eggs mostly on the leaves in clusters and which very conspicuous and are picked by hand and destroyed. D.D.T. 0·1 per cent spray in water kills the young larvae that emerge out of the unpicked eggs. *Begrada picta* attack is not very common nor regular. It appears only when the winter is dry and the summer sets in earlier. The seed is ready for harvesting by about the middle of May, when the plants are cut and stacked in heaps to allow the unmatured seed to ripen up. Then the seed is thrashed on a canvas or on a dung-mud plastered floor. The average yield is about 400 lb. per acre.

Carrot

The seed is sown in the middle of July in the field on well-prepared ridges at the rate of two to three seers per acre. The germination is usually poor and re-sowing has to be resorted to. Plants are thinned so that they are 2 to 3 ft. apart when they are about 2 in. tall. The roots are dug out and the shapely, healthy ones are selected for the preparation of root cuttings. Care is taken that only well-matured roots are selected for transplanting. Immature roots take longer to start sprouting and consequently delay harvesting. The roots are transplanted during the month of December. The root cuttings are prepared by removing about two-thirds of the lower portion of the root and by removing the leaves 1 in. from the crown end. The roots are transplanted on the flat in rows 2½ ft. apart and the plants 2 ft. asunder. One acre of the crop will approximately produce roots for sowing five acres, but in the case of turnip this ratio is 1 to 4 or even 1 to 3 if the distance of trunip roots from plant to plant is reduced.

The sprouting of the roots starts in the beginning of April when the roots are earthed up and flowering begins towards the end of April. In the case of cabbage and turnip sprouting begins towards the end of February and beginning of March, when the weather warms and the flowering starts by the end of March or in April. In the case of carrot, the flowering continues till rains set in. The early flowers start ripening in the beginning of July and the entire harvesting is completed by the end of the month.

The ripened umbels are cut by sickles and gathered in baskets (*killas*) and are sun-dried for three to four days depending on the weather. The entire field is gone over two to three times for completing the harvest. As the harvesting of this crop is done in July, considerable difficulty is experienced in thrashing it because of the rainy weather. The wet weather also imparts dirty colour to the seed. The average yield per acre is about 200 lb.

The carrot is comparatively free from the attacks of insects and fungal disease, but its roots are affected to some extent by root-rot after they have been transplanted and also when the shoots are in flowering stage.

Beet root

The beet sets seed easily at Katrain and is usually the healthiest of crops. Like carrot, the crop is slow in growth and late in ripening. The seed is sown on well-prepared ridges in the month of July at the rate of six seers per acre. The plants are thinned 3 to 4 in. apart when about 2 in. tall. The plants are ready for transplanting in November when the root cuttings are prepared in the same manner as turnip by cutting off one-third portion from the bottom and by trimming the leaves 1 in. high at the crown end. Rigid selection is made when preparing the root cuttings, keeping only the true-to-type roots for transplanting. Solid coloured roots and roots altogether lacking white streaks or rings should be selected for transplanting.

The cuttings should be planted in rows 2½ ft. apart and plants 1½ ft. asunder in rows. The transplanting should be completed in the month of November so that the root cuttings would take root before the onset of the cold weather. The plants should be slightly earthed up in December before it begins to snow.

In spring, in the month of March, seed stalks emerge and flowering starts in April. The crop is ready for harvest in July. When the seed has ripened, the stalks are cut and allowed to dry for three to four days after which the seed is thrashed. The average yield is 575 lb. per acre.

Dwarf or French beans

This is one of the normally self-pollinated crops and its seed can be produced without much difficulty. The different varieties of this crop may be grown close together for seed without danger of crossing.

The crop may be sown in a well-prepared soil in April when the season has warmed up, as the optimum temperature for the germination of the bean seed is about 75°F. The seed may be sown on ridges or in rows on the flat 1½ ft. apart. The seeds should be sown two to three inches apart and one inch deep, taking about 30 to 40 seers of seed to plant an acre.

After the crop has germinated, any gaps that may occur as a result of poor germination or depredations of the earth worms, which sometimes become very serious, may be filled in. Regular cultural attention should be given to the crop so that the growth is not hampered. When the plants have flowered and are forming pods, the off-type plants should be rogued out.

The crop is ready for harvesting in August, when the plants are cut and removed to the thrashing floor. The seed is beaten out. The average yield per acre is about 500 lb.

POOL PRICES OF SUPER-PHOSPHATES

SUPER-PHOSPHATES produced in India will now be available at a pool price of Rs. 227 per ton to provinces and States, according to a decision taken by the Central Ministry of Agriculture in pursuance of the recommendations of the Indian Tariff Board fixing fair ex-works prices of super-phosphates.

Super-phosphate is a chemical fertilizer useful for maintaining soil balance and stimulating plant growth. In India there are certain areas which are naturally deficient in phosphates, viz. the Madras Presidency, Mysore, Travancore, North Bihar and parts of the C.P. and Bombay. A judicious application of super-phosphates coupled with nitrogenous manures can add to the soil fertility considerably and increase production in these areas.

At present, a number of factories in India, situated in Travancore, Mysore, Madras, Hyderabad, Bombay, Ahmedabad and Delhi are producing super-phosphates. The entire production in the country is taken over by the Central Phosphatic Pool, maintained by the Central Ministry of Agriculture, and then distributed to the provinces and States, according to their requirements at a certain fixed price.

Taking into consideration the total production from all factories in India, the Ministry of Agriculture have now fixed Rs. 227 per ton f.o.r. despatching stations as the pool price for supply of super-phosphates to the provinces and States. The price will remain operative up to the end of this year.—*P.I.B.*

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SUGGESTIONS FOR AGRICULTURAL DEVELOPMENT IN INDIA

By S. RANBIR SINGH

AGRICULTURE is the primary industry of India. Most of our industries moreover depend directly on agriculture, e.g. textiles, sugar and alcohol, oil pressing and soap, leather and jute, etc. so that at the final computation agriculture maintains about 90 per cent of our workers. Agriculture can, therefore, be looked upon as the chief industry of India and the development of agriculture is the foremost problem before the country.

Before the war India with Burma was a food exporting country. During the last phases of war India faced food shortage, specially at the Burma War front (Bengal famine). Various factors, following in quick succession, culminating in the creation of Pakistan, have left India not only bleeding but perhaps seriously disabled, so that a number of experts believe that immediate steps shall have to be taken to avert a possible tragedy.

A 'grow more food' campaign was started by the then Government about five years ago. The propaganda was vigorously taken up by the press, the platform and on the air. There were several conferences of the Central and Provincial Departments of Agriculture. But the campaign did not seem to have achieved remarkable results. In 1947 a vital change was effected and the Government has passed into the hands of Indians. The steps that have been taken by the new Government are more practical, e.g. the ploughing up of Ganga Khadar, but the problem is an extensive one. The Multiple Purpose Projects, many of which are now engaging the Government's active attention, will provide the much needed irrigation and solve the power problem to some extent. Still the steps taken so far in the interest of the 'grow more food' campaign are more or less temporary and leave the crux of the problem practically untouched and the danger is that as long as no permanent solution is found the evil day is merely put off. And who knows what formidable proportions the evil might assume and what unforeseen calamities the future may have in store for us; floods, drought, failure of monsoon, war, remain unpredictable. It is, therefore, necessary that the earlier we adopt the remedial measures, the better our chances of success.

There is another drawback of procrastination and that is the enormous loss of buying power—millions of dollars that are now spent in buying foodgrains from foreign countries. This provides an additional reason why effective measures should be adopted before there is an actual breakdown.

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The suggested measures

For successful agriculture there are two important factors: (i) the land and (ii) man to manage it.

It is universally accepted that our soil is on the whole good if not rich, but it is also universally admitted that it is badly managed. The remedies, therefore, should be considered from these two angles. We shall consider the soil first.

Our greatest danger as far as soil is concerned is erosion—not only the scouring from high winds and floods but the slow yet sure displacement of rich surface soil by moderate local rain. For example it has been estimated that about eight tons of soil per acre is displaced by 3 in. of rain in a field having a slope of 1 in. in 100 ft. Such a slope can hardly be noticed. Of course the losses are far greater with steeper slopes. The remedy for large fields is now well known; the requirement is only a tractor equipped with a grader.

Most of our waste lands are uncultivable:

(i) because they are uneven or too rough for the bullock plough or too full of weeds; or

(ii) because they are unirrigated.

The long range solution of irrigation is sought to be found in the various big projects that are being taken up by the Government but an interim remedy well worth considering is the supply of water from the wells worked by oil engines. This solution is beyond the means of average ryots except on a cooperative basis but again Government lead is necessary to get things going. As an alternative Government can sink tube-wells and charge water rates.

The only practical way to bring the rough or uneven plots of land under the plough is to have, say, two tractors with necessary equipments for each district on the basis of an acceptable rate of payment which may be deferred in certain cases. The same tractors can look after grading too. The payment can cover either the maintenance of the machines and the personnel or the original cost of the equipment; in the latter case the machines may be passed on to cooperative ownership, the Government maintaining the staff.

As an alternative the machines can be cooperatively owned and may be employed for reaping and thrashing for extra income. Still the Government shall have to take the initiative by collecting the price along with the revenue or in some alternative way of equal simplicity.

Management

Our second problem, the man, is a much harder problem to tackle for the following rasons:

The cultivator (whether a landlord or a landless labourer) has gone on without education for centuries. The igorance has grown for untold generations till it has assumed colossal proportions. Although recent upheavals and the political awakening in the country has affected most persons, the farmer plods on stolidly in his former conservatism, unconcerned by the changes around him. As a result his sense of values is rather distorted and Government help, unless tactfully given, might be looked upon with suspicion.

The only permanent remedy of such appalling ignorance is to educate the coming generations in order to break the farmers' conservative nature. The problem of education is far from simple. The existing school is not only unsuitable, but it produces pernicious anti-agricultural trends. The need today is to evolve a new system in which the teaching is centred round agriculture and agricultural operations, the medium of instruction being the mother tongue.

To make the scheme practicable four or five villages should be organized into a unit with its own school, demonstration farm, independent water supply and a well-planned course of instruction and practical work in agriculture, in which the three R's have been well integerated. There should be compulsory attendance for all children of the unit between the ages 6 to 12 years.

Moreover, agriculture should be made a compulsory subject for secondary school (rural or urban). Reading courses should accentuate the importance of agriculture to the individual, to the worker and to the society. They should point out the phenomena of growth, the multiplication of seed, the balance of nature (give and take between animal and plant), what man-made selection has achieved, how new varieties are evolved by crossing, the importance of fruit growing and why cutting and budding are possible. The aim should be to make the new generation agriculture-minded; agriculture may with advantage be made an elective subject in all colleges.

The greatest problem of management is labour. Our farm labour is positively dishonest. With the landlord who works with the labourers, the output per head is roughly four times as much as that of the labourer working without supervision. Steps must be taken to see that the next generation has a greater sense of honesty, duty and responsibility. Young men must be awakened to the realization that they owe it to their country, their society and to themselves to be hardworking and trustworthy.

Village officials

Our food situation is so critical that the present day methods can hardly be relied upon. We cannot wait for the next generation to take over. It is of no use trying to make the ryot literate. The experiment has glaringly failed many times. The training of the adult should take the form of oral instruction with frequent demonstrations. It has been experienced that the persons wielding influence over the villager have

always evinced a hostile or at least suspicious attitude towards all new fangled ideas, particularly those advocated by the Agriculture Departments. For more successful results it is necessary to get the cooperation and help of all such persons as the *patwari*, the *lambardar*, the *zaildar*, etc. It is suggested that for an effective execution of this programme these village officials be given a short term training in the use of modern labour-saving devices and improved practices, so that they should be in a position to back up the programme not only with their moral support, but with conviction born of experience. The future recruitment of all village officials should be made conditional on their having undergone such a course of training in modern agriculture.

Moreover, to improve the present position of agriculture it is necessary that every village should have a set of bullock-driven labour-saving implements and all kinds of improved seeds. These would facilitate demonstrations and would induce people to go in for them for use on their own land, it being understood that such implements and seeds would be easily available. This would result in better preparation of seed-beds followed by better crops, resulting in higher yield per unit area. This will go a long way to ease our present position of food supply.

For greater advantage the school building can also be used as a centre for teaching and organizing village crafts, for village uplift work, for revival of village games, for radio installation, for visual demonstrations with slides and picture films.

LAND RECLAMATION IN THE CENTRAL PROVINCES

THE Central Tractor Organization of the Ministry of Agriculture is operating 96 tractors for reclamation purposes in the Central Provinces and Berar during the current season. The work is being done on a 'no-profit no-loss' basis. The tractors used in the Central Provinces are rehabilitated tractors taken over from the Disposals Directorate. Each tractor can reclaim approximately 0·5 acre per hour. A total area of 12,716 acres was reclaimed up to 21 March, 1949. During the current season a total area of 60,000 acres is proposed to be reclaimed.

The total area of weed-infested land in the Central Provinces, requiring reclamation operations in 6,00,000 acres. It is proposed to reclaim the entire area within a period of seven years under another scheme, which is at present under the consideration of the Government of India.—*Food Bulletin*, April 4, 1949.

TRAINING MIDDLE-CLASS FAMILIES IN PRACTICAL AGRICULTURE

By DEBENDRA NATH MITRA

THERE is a large number of young men belonging to the middle and lower middle class families living in the countryside and doing miscellaneous items of work to maintain themselves. They possess a little education, say up to the matriculation standard. Among their items of work there is some form of agriculture. I know of instances where young men possessing small shops are looking after cultivation of crops, in right earnest, on small areas of land of their own: there are instances also where many young men employed in business establishments on a monthly salary have been rearing ducks, goats, hens, etc. with zeal and enthusiasm. Growing of fruits and vegetables has been undertaken by almost all in addition to their usual employment. And there is also the rearing of fish in many cases. But every item of work is being carried on according to time-worn methods as they do not possess any knowledge of modern developments of any of the subjects. The local cultivators, fishermen and such other people are their guides. Many of them may be willing to take advantage of a practical training in the improved methods regarding these subjects. They have, however, no means to pay for such a training. Nonetheless this training will go a long way to augment their income and in addition assist very greatly in the introduction of improved methods in the countryside.

There are also many young men with more or less similar education living in the countryside and ekeing out their existence anyhow; they are desirous of adopting agriculture or any branch of it as a profession if facilities in the shape of land and money are extended to them. They are also unable to meet the expenses of their training prior to the adoption of this useful occupation.

A scheme may perhaps be prepared to afford facilities of training to both the classes of young men mentioned above and to encourage the latter to take to agriculture as an useful occupation on small areas of land in the rural areas. A scheme may perhaps be prepared on the basis of the scheme worked out by me at the Government Agricultural Farm, Faridpur (now in Eastern Pakistan) to settle members of middle-class families with *khasmahal* lands after a year's practical training in agriculture. The training did not cost the trainees very much nor was the Goverment involved in much expenditure on this account.

The scheme of training may be briefly stated. It provided one year's training in practical agriculture at the Government Agricultural Farm, Faridpur, with instructions in agricultural carpentry, elementary veterinary practice, and principles of co-operative credit. During the period of training the youths were required to work at the farm as labourers and were paid Rs. 12 a month each for their labour on the farm to enable them to meet the expenses of their food. They were given free accommodation on the farm but were required to bring their own utensils, bedding, lights, etc. and to arrange for their own meals. After the year's training each youth received provisional settlement of a 15-*bigha* plot of *khasmahal* land free of rent for three years and was advanced Rs. 200 by Government under Land Improvement or Agricultural Loans Act for initial expenses. These advances were made on the personal, joint and several security of two persons acceptable to the Collector. The advance with the usual interest was recoverable in four annual instalments commencing from the seond year after the money was advanced. There was a further condition that if for any reason the provisional settlement was terminated by the Collector at any time, the whole amount or such balance as was outstanding would be immediately recoverable from the two sureties. Having

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been given the land and the loan each youth was required to bring the land into cultivation on his own and was not allowed to let out the land on *barga* settlement nor in any other way sublet the land or any portion of it. At the end of the three years, provided satisfactory progress was made, an ordinary *raiwatari* settlement was made on the usual terms obtaining in the Government Estate in which the land was situated; no *salami* was charged. There was also a provision in the scheme for the settlement of more land at the Collector's discretion up to the limit which could be cultivated by each youth and his family. The work done on the land would be inspected twice every year by the District Agricultural Officer and the *khasmahal* Officer and the Collector would decide on their reports whether the arrangement should continue.

According to the above scheme the first batch of five boys was taken for training in March, 1928. It continued for six or seven years. The youths after training showed considerable energy and enthusiasm in their work and laboured hard to make their venture successful. They lived in *kutcha* sheds in far-off *char* lands in the midst of the cultivators and, like the cultivators, did all the operation with their own hands and even cut jute in knee-deep water. They used to cook their own food. On the whole, they set an example of the dignity of labour. But unfortunately they were not provided with suitable lands. In almost all the cases newly formed *char* lands were given to them which used to go under water during the rains and the water remained on the lands too late to grow any *rabi* crops on them. The only crops they could grow were deep-water paddy and jute. Moreover, being far away from the town and having no cheap transport facilities they could not market their produce like winter vegetables, tobacco, groundnut, etc. easily and profitably. In one area the youths grew groundnut but having no local market for it they had to bring it in a country boat to the nearest town, a distance of about 20 miles. And the cost of transport was very heavy causing them considerable loss. The success of a venture like this depends chiefly on suitable lands capable of producing two or more crops and upon the proximity to towns with easy transport facilities.

The scheme however attracted notice of many provinces and enquiries came from many quarters. It also received blessings and encouragement from many eminent persons. The late Sir P. C. Ray contributed an article about it to the *Modern Review* in April, 1929, under the caption 'Dignity of labour taught at the Government Farm, Faridpur'. The Revd. W. S. Urquhart, the then Vice-Chancellor of the Calcutta University, said thus in course of his presidential address at the Faridpur Agricultural and Industrial Exhibition, 1930: 'There is connected with it a scheme for the education of members of middle-class families in such a way that they will be able in a comparatively short period to support both themselves and their families honourably and comfortably. I was greatly impressed this morning visiting the small colony of these young men who are doing work here, to see how vigorously they were throwing themselves into the work and how happily they seemed to live together in this useful occupation. I was greatly interested also in the record of those who have already gone forth from the school to take up land of their own, to hear how successful they have been in this new enterprise. The enterprise is at present small in extent, but surely it has great promise in it, and if only it could be extended to other districts throughout the whole of India a great deal might be done to relieve some of the present problems. It can be largely extended'.

Sir John Anderson, the then Governor of Bengal, inspected the working of the scheme on 24 July, 1933 and observed thus: 'It was to me a most interesting experience. During my visit the various processes of the farm—ploughing, transplanting, mixing manures, were being carried on by young *bhadralog* youths under training. This is a most interesting feature of the work at this farm. An attempt is being made to tackle the problem of *bhadralog* unemployment by training young men of middle-class families in agriculture and then settling them on the land as *khasmahal* tenants. The young men are given a year's training on the farm during which period they are required to work as common labourers at a daily wage and to share quarters on the farm. I saw their quarters during my visit and found them simple but healthy and neatly kept. They do everything for themselves there. It is early yet to say how far this

most interesting experiment has succeeded and I understand that some at least of the young men trained on the farm are having a struggle to pay their way. This is, however, partly due to the flooding of the *char* lands on which they have been settled. I shall watch with interest the progress of the experiment'.

Changes in the laws relating to land are likely to be made soon but a scheme based on the lines mentioned above with necessary modifications may be prepared to suit the conditions of middle-class young men. It will mean no harm; on the contrary it will be good for the country to disseminate as much information as possible on the improved methods of agriculture and allied subjects. And it is high time to do it.

INTERNATIONAL CONVENTION ON PLANT PEST CONTROL SINGAPORE CONFERENCE

A CONVENTION detailing the measures to be adopted with a view to prevent the introduction of foreign plant pests and diseases in South East Asian countries was adopted at the Phyto-Sanitary Conference, which met at Singapore and was attended by representatives of 16 countries including India. The Conference was convened by the Commissioner- General for South East Asia of the Government of the U.K. with the cooperation of the F.A.O. of the United Nations. Dr H. S. Pruthi, Plant Protection Adviser of the Central Ministry of Agriculture, represented India at the Conference.

The main terms of the Convention which has been circulated to participating Governments include (a) legislation on plant protection in member countries; (b) measures for preventing the introduction of foreign pests and (c) to exercise such minimum control on specified plant imports as may be deemed necessary by the majority of the signatories. It was recommended that the area covered by the Convention should be: Brunei, Burma, Ceylon, China, Fiji, Hong Kong, India, Indo-China, Indonesia, Federation of Malaya, New Caledonia, New Guinea, North Borneo, Pakistan, Papus, Philippines, Portuguese Timor, Sarawak, Siam, Singapore and those islands in the Pacific Ocean bounded by Lat. 30°N. and 30°S. and Longt. 140°E. to 150°W.

Although organized plant protection work was started in India only three years back, legislation on plant protection and quarantine measures was passed as early as 1914. The Conference was greatly impressed by the Indian legislation and recommended it to member countries for consideration while adopting similar measures in their areas. India's plant protection work was considered to be run on sound lines and the Conference recommended many of the measures already existing in India for adoption by other countries in this respect.

What the Scientists are doing

RESEARCH ON PRAWNS

THE prawns are of considerable economic importance bacause of the protein food they provide. There is considerable demand for internal consumption as well as for export. The Indian Council of Agricultural Research has been sponsoring a scheme at the Madras University for the study of the biology of the marine prawns of commercial importance of the Madras Coast, with special reference to *Peneus indicus*, *Peneus carinatus*, and *Metapeneus monoceros*. This scheme has been recently completed.

It has been observed that the most common species among the marine prawns of commercial importance of Madras coast is *Peneus indicus*, the next in abundance is *Metapeneus monoceros*. The ratio of the occurrence of the three species in an average catch came to 15 : 1 : 2. All the species mentioned above were more plentiful in the brackish area of Cooum and Adyar. Of the total number of mature prawns collected from all the areas surveyed, the number of males was 1,386 and females 4,533. It is thus evident that the females are in excess of the males.

The gut contents of these penaeid prawns were composed of small fragments of different algae, a few protozooa and lower crustacea. It seems these prawns feed upon both vegetable and animal matter. No distinction in food materials either of the prawns collected from the sea coast or the backwaters and between the different age groups was noticed.

Full grown forms of these three species of penaeids occur in all the areas surveyed throughout the year. The immature forms were, however, found in large numbers in backwaters during the monsoon period, when there is free flow of water between backwaters and the sea. A slow gradation of growth can be seen from November onwards after the young stages have entered the backwaters, when the flow of water between the backwaters and the sea almost ceases. The rate of growth appears to diminish as the prawns grow older.

These prawns in their post-larval phases, about 10 to 25 mm. in size, enter the backwaters during the period of monsoon when the bar is open. This can be recorded as the time for inward migration of these penaeids from the sea into backwaters. The brackish water environments appear suitable for the quick growth of these young prawns. The grown-up prawns of the previous season present in the backwaters migrate into the sea for fuller growth and breeding. The larval forms of these penaeid prawns are recorded in the marine plankton only but not in the backwaters showing thereby that the breeding takes place in the sea. The cold monsoon period between October and February appears to be the favourable breeding season of these penaeids as the protozooa larvae of these crustaceans are observed in examinations of the marine plankton during this period, which can, therefore, be taken as the intensive breeding season of these prawns. (I.C.A.R.).

You ask We answer

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and States. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. In parts of the United Provinces people store wheat straw in towers, the walls of which are made of *arhar* straws. The towers are thatched up at the top. The capacity of each tower is from 20 to 30 maunds, there being different sizes according to the quantity of chaff to be stored.

Such towers are called *burjis*. Can it be possible to fill such towers with green fodder for silage? Ventilation can be effected through spaces between the stalks; but if air is not required the walls can be mud-plastered making the towers comparatively air-tight.

A. Throughout the civilized countries, where silage is made, the receptable for ensiling is constructed from various materials. Broadly speaking we have the pit silos and the tower silos. The materials used in the construction of these are:

Concrete, masonry, concrete and masonry combined, stone and wood. Besides these, *katcha* silo-pits can also be used.

Whatever may be the material used in the construction of either a silo-pit or a silo-tower, the following points seem to be of paramount importance in the art of ensiling:

(i) The tower or the pit should be water and air-tight.

(ii) The walls or sides should be sufficiently thick in order to prevent the drying action of the sun.

(iii) When a considerable quantity of green fodder is packed into a tower, specially when the material ferments, there is considerable amount of pressure exerted by the material on the sides.

Burjis cannot answer the requirements mentioned above and, therefore, these towers cannot be used for preserving silage. (Y. C. G.)

What's doing in All-India

MADRAS

T. S. FRANCIS

IN order to prevent the heavy toll of crops taken by pests and diseases year after year, the Madras Government have taken up measures to intensify plant protection work in the province. Four Plant Protection Officers (one Mycologist and one Entomologist at each of the two divisions of the province) and 52 assistants (two for each district) specially trained in modern methods of plant protection work and equipped with the most effective chemicals and machinery for pest and disease control have been appointed from January 1949. The Plant Protection Staff works in close collaboration with the Agricultural extension staff and attends to all calls for aid in controlling incidences of pests and diseases in the districts. The following is an outstanding instance of pest control work carried out in the province during the past few months.

The grasshopper (Hieroglyphus banian *F.*) *pest on paddy : Kistna District.*

During September, 1948 the grasshopper pest of paddy (*Hieroglyphus banian* F.) appeared in a severe form over 2,000 acres of the fertile paddy lands of Gannavaram and Gudivada *taluks* in Kistna district, and in a minor form over larger areas. As the pest was at the adult stage, the approved methods of controlling it at its egg stage were of no use and Gammexane D.025 (5 per cent benzene hexachloride) was dusted over small areas as an experimental measure. The results were startling. A very big death-rate of hoppers (both nymphs and adults) was noted in three to four hours after dusting and nearly 100 per cent mortality was recorded 24 hours after dusting. Encouraged by these results, larger demonstrations were carried out on the fields of cultivators in the worst infested villages. The cultivators were fully convinced of the efficacy of this treatment and came forward in large numbers for supply of the chemical and dusting appliances. To cope with this sudden demand, all the firms in Madras were immediately contacted and their stocks of dusters and Gammexane D.025 requisitioned and the campaign against the grasshopper was launched on a large scale. The campaign was pushed through with vigour using eight crank dusters each of which covered two to three acres per day and a power duster which covered 20 acres a day. Ryots were so enthusiastic about this treatment that they started dusting the affected fields with their hands and even this method proved effective.

A total quantity of 110 cwt. of Gammexane was used over about 800 acres. The cost of 20 lb. of Gammexane required per acre works out to Rs. 10-8 including the cost of labour required for dusting. The quantity of grain saved was on an average five bags, i.e. about 600 lb. per acre. The value of this produce works out roughly to Rs. 60 per acre. Deducting the cost of the treatment, the cultivator gained Rs. 50 per acre and the total benefit to the ryots of this area worked out at Rs. 40,000. Apart from this financial aspect, the fact that there was a saving of a total quantity of 4,000 bags of paddy at this time of general food shortage in the province is of great significance. Further, the marked success obtained with this insecticide against a common pest opens up great possibilities for wider application of this effective method of control.

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The coconut nursery scheme

With a view to meeting the growing demand for quality seednuts of coconuts in Madras Province, the Government of Madras sanctioned

in October, 1948 a comprehensive scheme for the establishment of coconut nurseries in the important coconut regions. The nurseries are located at the following centres: Samalkot (E. Godavari district), Pattukottai (Tanjore district), Pattambi (Malabar district), Nileshwar (S. Kanara), Palur (S. Arcot), Central Farm (Coimbatore), Marateru (W. Godavari) and Anakapalle in (S. Vizag district).

It is proposed to supply 1,60,000 seedlings from selected nuts every year from these nurseries. The Indian Central Coconut Committee has approved of this scheme and agreed to bear half of the total expenditure of Rs. 7,25,062 on the scheme spread over a period of five years.

The Government are contemplating the establishment of a coconut nursery in Tiruchirapalli district also under this scheme and proposals are under consideration.

Horticultural courses for fruit development in Madras

The Province of Madras abounds in resources for the development of fruit-growing and contains a very wide variety of fruits. In fact, Madras monopolizes the growing of some of the rarer types of hill-fruits and spice-producing trees in India. With a view to developing these great resources and make fruit-growing a paying industry the Government of Madras sanctioned in August, 1947, the proposal of the Director of Agriculture to start horticultural courses.

The Hon'ble the Premier of Madras inaugurated the first diploma course in Horticulture for 20 graduates and a certificate course for 25 fieldmen in August, 1948. The diploma course is for one year, the first nine months of which will be devoted for the actual training at the Horticultural Gardens, Teynampet, Madras (kindly placed at the disposal of the Director of Agriculture, Madras) and three months for tours to places of horticultural interest in South India for studying orchard practices of the various fruits under different climatic conditions. The majority of the students for the diploma course and all of the students for the certificate course are drawn from the personnel of the Madras Agricultural Department. There is provision in this scheme for training students from other provinces who may be deputed by their Governments. The scheme has been sanctioned for two years from the date of commencement in the first instance.

WEST BENGAL

(72)

P. S. MAZUMDAR

IN the context of food deficiency in Indian Union and the gloomy international food position, West Bengal, like every other province, is now strenuously endeavouring to speed up her agricultural development. She is now confronted with problems of enormous magnitude in that she has to produce enough food for her growing population; in addition she has to rehabilitate East Bengal refugees and she has to produce sufficient raw materials required by her industries. A resumé of some of the more important recent developments in these fields in this province is given in this article.

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Provincial Board of Agriculture, Animal Husbandry and Veterinary Aid

In the undivided Bengal, a Provincial Board of Agriculture, Animal Husbandry and Veterinary Aid was formed with a view to advise Government on all matters relating to the advancement of agriculture including animal husbandry and veterinary matters and fisheries. After partition of the province, this Board has been reconstituted. Since its inception, the Board has met twice, once in June and again in November, 1948, when it reviewed the various activities of the Directorate of Agriculture.

Utilization of waste lands

A scheme to reclaim culturable waste lands by mechanical means has been taken up with the tractors at present available. Naturally, because of the small number of tractors available for this work, the progress is slow at present; but with the availability of more tractors, the pace of this work will be accelerated. At present work is in progress in Jalpaiguri district, where a block of 1,400 acres is being reclaimed. After reclamation the land will be settled with East Bengal evacuees.

To utilize railway surplus lands, 2,070 acres of such lands were leased to bona fide cultivators during 1947-48.

With a view to maximize the production of jute, the Jute Regulation Act, in force in this province, was amended to permit the cultivation of jute on waste lands. As a result, 66,420 acres of such lands went under jute, giving an additional production of 187,425 bales.

Irrigation

To extend the irrigated area, the following irrigation schemes have been taken up for implementation this year:

(i) Seven pumping plants, each of a capacity to command an area of 100 acres, have been hired out as a demonstration-cum-food production scheme to popularize pump irrigation in the province. A rent of Rs. 1,400 per set per year is charged from the user. This allows a subsidy of 50 per cent on the working cost.

(ii) Twenty minor irrigation and drainage schemes for excavating silted channels have been selected for implementation. Already two of them have been executed in the district of Burdwan, whereby 2,500 acres of land have been brought under paddy.

(iii) Preliminaries are being worked out of a pilot scheme to sink 40 tube-wells within an area of 6,000 acres.

(iv) One hundred and seventy-five Persian wheels, 20 Egyptian screws and 1,000 Dones are being manufactured for distribution among cultivators.

Plant protection

Potato, a very important cash crop of the province, badly suffers almost every year due to the attack of blight diseases. To fight these diseases, arrangement has been made to spray 7,000 acres in two important potato-growing areas in the plains this year. The work is in progress.

Work has also been taken up to treat paddy seed with Agrosan GN with a view to control seed-borne infection of Helminthosporium.

Jute seed multiplication

As a sequel to partition of the province, its jute industry has been very seriously affected due to her dependence for raw materials upon East Bengal. In order to increase jute production through use of improved seeds, a 300-acre jute seed multiplication farm is being established at Raigunj in the district of West Dinajpur where conditions suitable for raising jute seeds are prevalent. However, pending the establishment of the farm, improved jute seed has, this year, been multiplied in forest areas of Jalpaiguri and Midnapore districts as well as at some of our existing farms.

MAKING RICE MORE NUTRITIOUS

By PAUL WEST

MORE than 50 per cent of the world's population live on rice, the staple diet of many Asian countries. Rice has a lower nutritional value than grain, but it contains starch, minerals and most important of all—vitamin B, which years of research have proved to be indispensable in the prevention of the paralytic disease known as beri-beri, so widespread in Eastern countries. It is, therefore, essential that the valuable substances should be retained as far as possible during the milling of the rice grain for human consumption.

Rice-milling consists mainly of the hulling and whitening processes, the latter being known in some countries as pearling, polishing or scouring. Hulling removes the coarse, inedible husks which have no nutritional value and which if fed to cattle, can cause physical injury. After hulling, the rice is whitened, a process which imparts the brilliant pearliness to the rice grains.

The conventional mechanical methods of hulling and whitening, however, have the disadvantage that they tend to rob the rice of some of its mineral and vitamin B content. These valuable constituents are contained in the germ and in a thin aleurone layer of the bran. Hulling normally causes the germ to break. Tests have shown that about 95 per cent of the germ is lost in this way. In the subsequent whitening process, a large proportion of the aleurone layer is removed, so that the finished, highly-polished rice hardly contains any minerals or vitamin B. What remains is only a starch product.

Main principle

It is obvious, therefore, that the invention of improved methods of hulling and whitening augurs well in the interests of the rice-eating peoples of the world. A British firm has succeeded in constructing milling machines which do not harm the mineral and vitamin B content of the rice. One of these machines is the Wemanco Ideal Huller in which only a very small percentage of the germ breaks. This is due to the fact that the machine does not depend upon the use of milling stones or abrasives, but uses a combination of rubber and metal. Moreover, the husk is removed in a single operation.

The remaining treatment of the rice grain is replaced by gentler methods. The main principle involved is that the rice grain is transported to the shelling point on a continuous rubber band. The underside of the grain is embedded firmly into the rubber band so that it cannot slip about. On reaching the hulling point, the berries, containing the valuable constituents, are ejected from the husks. In this way, every ripe grain, irrespective of size or shape, may be hulled. The delicate tips of the grain do not get chipped; none of the nutritional endosperm is lost and even protruding germs remain intact. The machine is capable of hulling one ton of rice an hour.

Polishing process

The second machine is the Wemanco Ideal Whitener, a polishing machine operating on an entirely new, scientific principle. The whitening is carried out by means of a specially grooved rotor, the movement of which causes the meal to be peeled off the rice grain. At the same time, the mass of rice is subjected to a friction-process by a rapid pulsating movement. Throughout the entire treatment the rice is safeguarded from any undue pressure, so that the percentage of breakage is very low.

The finished rice leaves the machine with an attractive white pearliness. By means of a special regulating device, the degree of

polish may be varied according to requirements. Should a few rice grains remain unpeeled in the machine, the husk residue may be disposed of by the action of the rotor. The machine which has a very low current consumption, is enclosed in a dust-proof metal casing and it is capable of dealing with 1,000 to 1,500 lb. of rice an hour.

These British-made Wemanco machines are the result of 50 years' research in the field of mechanical rice milling. Many rice-consuming countries have shown a lively interest in these new developments because they realize the importance of such inventions in raising the standard of diet and health among the rice-eating peoples of the world. (B.I.S.)

RESEARCH ON EGGS AT IZATNAGAR INSTITUTE

RESEARCH carried out on the production of eggs by Indian birds at the Indian Veterinary Research Institute, Izatnagar, show that under controlled conditions considerable improvement can be effected both in the quality and quantity of eggs produced. A pen of indigenous fowls was raised in 1939 from the ordinary bazar eggs at the Izatnagar farm. By pedigree breeding over a period of nine years, controlled system of feeding, housing and management the Institute has been able to produce 150 eggs per bird against an average production of a little over 100 in a year. Individual birds have laid well over 200 eggs each weighing near about 2 oz. Furthermore, these birds have stood well the adverse climatic conditions prevailing in the country. They eat relatively less, at the same time laying as many eggs as pure-bred fowls in this country.

Controlled breeding has also provided for increased rate of growth, early maturity, a definite and progressive increase in the weight of eggs as well as the average egg production of the hens. The improved village fowls of Izatnagar have won challenge cups and first prizes consecutively for two years at the All-India Poultry Shows held in New Delhi.—*Food Bulletin*, April 4, 1949.

NATURE CONSERVATION, NATIONAL PARKS AND BIO-AESTHETIC PLANNING IN INDIA*

By M. S. RANDHAWA

WE are indebted to Professer Lancelot Hogben for the term 'bio-aesthetic planning' which may be defined as conscious planning of the flora and fauna with the object of beautifying the country. Bio-aesthetic planning embraces both the animal and plant sciences, botany and zoology, and may be further defined as planned ecology of living beings from the artistic and aesthetic point of view. It includes the aesthetic planting of ornamental flowering trees along city roads, in parks, public places and compounds of houses both in towns and villages, planting of trees of economic values which yield timber, fuel and fruit along roadside and our national and provincial highways and district and canal roads, and on waste land in villages and development of national parks for the preservation of useful and harmless birds and animals, and creation of bird sanctuaries. The object of our bio-aesthetic plan for India is the encouragement of planting of selected ornamental flowering trees in our towns and villages, protection of beautiful harmless birds like wild ducks, egrets, geese and sarus cranes, by legal declaration of some of our big *jheels* (lakes) as bird sanctuaries, and preservation of graceful animals, which are being ruthlessly exterminated, such as black-buck, blue bulls, *sambhars* and spotted deer in national parks and zoological gardens in the vicinity of our big towns.

* This is the concluding portion of the article; the earlier part has appeared in *Indian Farming*, June, 1949.

M. S. RANDHAWA, I.C.S., formerly Secretary, Indian Council of Agricultural Research, is now Deputy Commissioner, Ambala (East Punjab).

A tree plantation plan

Just as we are planning the development of industrial and agricultural resources of our country, we should also have a national plan for encouraging the growth of fruit, timber and ornamental trees. In drawing the plan we have to consider the choice of trees for each climatic zone of the country and also take into view the soil and water supply. We have also to clarify our ideas regarding the choice of trees for various purposes, e.g. planting roadside avenues, city roads, canal banks, public parks, platforms in railway stations and compounds of private houses. We have to assign ornamental flowering trees, shade trees, timber trees and fruit trees to places where they can best fulfil their function. At present we see the irritating spectacle of fruit trees being grown indiscriminately in the compounds of houses, and timber trees in public parks and city roads.

The plan

In brief we may sum up our tree plantation plan for India as follows:

1. Bio-aesthetic planting for compounds of private houses, dak bungalows, banks, hotels, universities, colleges, schools, public offices, town roads, public parks and platforms of railway stations. For these places we should select trees with beautiful flowers and foliage to beautify them and to give pleasure to the people. *Kachnar*, pink cassia, erythrina, milletia, *amaltas* and *gul mohur* come under this category.

2. Roadside avenues of our national, provincial and district highways. The sole criteria for selection should be shade plus economic utility. For this purpose, trees which yield timber or fruit and are also shady should be

selected such as *mahua*, mango, tamarind, *neem* and *sheesham*.

3. Canal roads. We should plan all canal roads with fruit trees like mango, *jaman*, *kathal*, etc. The stones of varieties like *langra*, *dussehri*, *sufeda* and *fajri*, yield excellent fruit trees which are better than the *desi* mango. There are thousands of miles of canal roads which can be planted with fruit trees thus adding a valuable source of vitamins to the deficient dietary of our people.

4. Village plantations. Fruit, timber and fuel are the main requirements of villages. Fruit trees like mangoes, lemons, papaya, *kathal* and sweet limes are recommended for planting in the compounds of village houses, *phulwaris*, and along the bullock runs of wells fitted with Persian wheels. The plantation of *bakain* and mulberry trees in the compounds of cattle sheds should be encouraged.

Bio-aesthetic planting

Public places which belong to the community as a whole rather than individuals should claim preference in bio-aesthetic planting. A larger number of persons, especially those who are unable to afford private gardens of their own, will thus be able to enjoy the sight of beautiful flowers. Public parks and squares, public roads, platforms of railway stations, compounds of hospitals, universities, colleges and schools, ancient historical buildings under the supervision of the Archaeological Department, compounds of courts, office buildings of municipalities and district boards, and dak bungalows of the Public Works Department, Canal Department and District Boards are places in towns which are susceptible of bio-aesthetic planning and should claim preference in our programme for the beautifying of our towns and cities. Proprietors of hotels and banks, and owners of new bungalows should also be encouraged and given all assistance in the planting of ornamental trees.

Town planning and bio-aesthetic planting

Town planning and bio-aesthetic planting go hand in hand. Orderly and planned planting of ornamental trees can be seen to its best effect in new towns with wide roads flanked by shady footpaths, well-laid-out public parks and squares, rather than in congested old towns with narrow crooked streets. Our old towns offer little scope for bio-aesthetic planting. Firstly they contain no open places suitable for planting and secondly their streets and roads are too narrow.

Our old towns

Town planning is a precondition of bio-aesthetic planting. We have allowed our towns to develop without any plan or order. In our country *laisser-faire* has really gone amuck and the results have been most unfortunate. Ugly ill-ventilated houses joined together in monstrous piles along narrow, crooked lanes that is how our ancient towns like Old Delhi, Lucknow and Banares appear to an outsider whose eyes are accustomed to western orderliness. And not a patch of green in these prison-like piles of masonry. These houses may have been suitable in medieval, insecure times when security was the guiding principle in our domestic architecture rather than ventilation, but at present they appear anachronisms and fossils of a social and economic order which disappeared long ago. In these old towns, and their bazaars we see a reflection of our disorderly and undisciplined social and economic life. They may appear romantic to foreigners who come to our country in search of oriental mysticism and magic, but are certainly not fit for the growth of a healthy nation. It is time that we realize that we had enough of these smelly streets. The younger generation must be educated in a new mode of living. We must improve the environment which surrounds the individual in our towns.

Improving old towns

A very pertinent question arises about the fate of these old towns. What should be done with these ancient insanitary slums? These old towns are in need of drastic surgery. We must decongest these old residential areas by compulsorily acquiring suitable central housing areas, and after demolishing the ugly houses thus acquired, we should develop parks and open places in the sites thus acquired. Improvement Trusts have done useful work at Kanpur, Lucknow and Allahabad, but the rate of progress is snail-like and painfully slow considering the tempo of modern life and our requirements. In the parks thus made, bathing tanks should be

constructed for the enjoyment of citizens in hot weather and incidentally for irrigating the trees and lawns.

The garden suburb should be our ideal in this hot country for vertical development is unsuitable considering the summer heat and flats are positively uncomfortable in hot months. Moreover, the development of motor transport has greatly facilitated horizontal and peripheral development of towns. So far as possible the growth of these garden suburbs should be planned in a concentric manner to economize fuel for motor vehicles.

New towns

With the influx of refugee population from Western Pakistan into India, the problem of raising new townships in the vicinity of old towns has assumed great importance as well as urgency. The surplus refugee population is mainly urban and must be absorbed in the urban economy of India. Besides there is also a proposal to build a new capital for the East Punjab. So the problem arises, what should be our ideal in this new town development? The garden city should be our ideal and the Welwyn Garden City in England, and the Model Town of Lahore provide an example which may be profitably followed in the development of new population centres. For our city of the future, *Le Corbusier* model with many-storeyed offices and factories linked with the garden suburbs by means of bio-aesthetically planted roads, will be very suitable. People will work in the production hub of the city during daytime and will scatter again in the garden suburbs in the evening enjoying their life in healthy, quiet, noise-and-dust-and-smoke-free surroundings.

Bathing tanks

Public bathing tanks should form an essential feature of these new towns. People can enjoy themselves in these tanks during summer and their waste water can be used for irrigating the public parks and gardens, which should be planted with ornamental flowering trees. Canals where available can also serve a useful purpose and also provide excellent opportunities for scenic planting and beautifying the towns.

Road plan and tree plantation plan

For our towns we are not only in need of 'road plan' for traffic but also 'tree plantation plans'. For every town of importance a 'tree plantation plan' should be drawn and rigidly adhered to. For new roads it is comparatively easy to plan plantations of unfamiliar flowering tree, and it is the old roads which present a problem.

The only practical solution is replacement of dead, decaying and old trees according to a plan. Once a plan is made, it should be rigidly followed not only in new plantations but also in replacements.

Choice of trees

While shade and economic utility should be the criteria for selecting trees for national, provincial and district roads passing through the countryside, different types of trees are required for town roads. For roadside avenues in towns and cities, shade and beauty are the sole criteria which we should consider while selecting trees. Unfortunately there are very few trees which combine shade with beauty of flowers, for the large majority of our flowering trees are deciduous. Where space available is so limited that only one row of trees can be grown on each side of the road, flowering trees like *gul mohur*, *amaltas*, *Jacaranda*, *Erythrina* and *Spathodea* may be grown alternating with shade trees like *Eugenia operculata*. Choice should be restricted to one species only for each street. Very tall trees like *Eucalyptus* and *Millingtonia*, and trees with spreading crowns like banyan, are unsuitable for town roads, for they interfere with electric wires. Medium-sized trees like *Eugenia operculata* and *pakur* (*Ficus infectoria*) which are extensively grown in New Delhi, are ideal for shade while for beauty we have a large number of trees to choose from.

Double avenues for cities

Double avenues of trees are a necessity in big cities, where wide roads are available. The outer row should be of shade trees like *Tamarindus indica*, the inner of ornamental flowering trees. The outer row should be composed of evergreen shade trees with dense foliage, such as *Tamarindus indica*, *Polyalthia longifolia*, *Eugenia operculata*, *Purtanjiva Roxburghii*, *Mimusops elengi*, *Ficus retusa*, *Azadirachta indica and Ficus infectoria*. The

function of the outer row is to provide only shade. These trees should be planted in pure avenues. The inner rows should be planted with ornamental flowering trees only. The outer rows of shade trees will provide shade for pedestrians on the footpaths and at the same time will furnish a green background for the pink, red, crimson and yellow flowers of the flowering trees.

Some colour schemes

While most of the flowering trees look beautiful when planted in pure avenues, there are some species which flower at the same time and the colour of their flowers also harmonizes and hence they appear more effective when planted together. Some of the flowering trees which flower in the same season are grouped below in schemes with due regard to colour harmony and are recommended for planting along our town roads.

Yellow flowered *Cassia fistula* grown alternating with *Poinciana regia* provides a very striking colour scheme, the rich yellow colour of *amaltas* flowers contrasting with the scarlet orange colour of *gul mohur* blooms in the month of May when both the trees are flowering.

The three varieties of *Bauhinia variegata*, pink, white and purple-mauve, and light magenta (*B. Krugi*) grown alternating with each other is suitable for dust-free roads of residential areas. All these Bauhinias blossom in a leafless condition from the middle of February to the middle of March when they look like huge bouquets of pink, white, purple and light magenta flowers.

Tree planting plan for New Delhi

The tree plantation plan of the modern city of New Delhi can serve as a model for many of our towns. When Sir Edwin Lutyens came to New Delhi, he asked for a list of trees which could grow here. Griessen of the Horticultural Department prepared a list of trees and tree-like shrubs that might be made use of in the planting of the New Capital at Delhi. Griessen planted the first laid-out roads, but on account of unsatisfactory water supply most of the roads had to be replanted several times. Griessen retired in 1920 and was followed by Mustow who established the nursery at Jor Bagh opposite the Safdar Jung Tomb. Henceforward all tree-planting in New Delhi owed its existence to Mustow. He afforested the ridge. He introduced the *Prosopis juliflora* from Mexico, and thus gave India a hardy tree which may even help to make Rajputana green. Generally roadside avenues were inter-planted; quick growers between the permanent and slow growers. Most of that inter-planting has been cut out. Extensive use has been made of many of our flowering trees for brightening up the housing areas, squares and circuses. For roadside avenues *Eugenia operculata* with its light green leaves has been found to be the most suitable. It sheds its leaves in late February, and renews them in early March, after remaining leafless for only a few days. It has a compact semi-globose crown and its light green leaves appear very soothing to the eyes. Avenues of these beautiful evergreen trees adorn the parks on both sides of the Kingsway and are also planted on many roads. Other successful roadside trees are *Kigelia pinnata*, *Pongamia glabra*, *Ficus retusa*, *Ficus infectoria*, *Celtis australis*, *Sterculia alata*, *Cassia fistula*, *Anthocephalus indicus*, *Piptadenia oudhensia*, and *Melia azadirachta*.

The Secretariat and the Viceregal buildings are the nucleus of the lay-out of New Delhi and a number of roads radiate out from them. The clipped bushes of *Diospyros cordifolia* in the lawns in front of the Government of India buildings look very attractive. The trees annually receive a light pruning treatment, the branches being cut at a certain distance above the ground. This leaves space for pedestrians to wander below, and the Pathan-type of hair-cut, which the trees receive, gives them a trim and smart appearance. The clumps of Jacarandas at the corners of the two Secretariat buildings are a sight in the month of April.

Most of the circuses in the centre of road junctions are enlivened with clumps of flowering trees like Jacarandas, *amaltas*, *gul mohurs* and *kachnar*. Where space available is narrow, use has been made of shrubby climbers like the various species of *Bougainvillaea* and *Petraea volubilis*.

The squares in housing areas have been planted with all types of flowering trees. The *semals* in Hastings Square with their flaming red flowers are a sight in the months of March

and April. Purple and mauve *kachnars* lend their grace to many squares, though they have a rough time at the hands of inhabitants who pillage their buds ruthlessly for preparing curry.

Flowering trees have also been planted at the edges in the compounds of bungalows which are maintained under the supervision of the Public Works Department. At the gateways bottlebrush trees with pendulous branches are commonly grown. We also find trees of *Jacaranda mimosaefolia, Bauhinia variegata, B. purpurea, Etryhrina indica, Grevillea robusta* and *Ochna squarrosa.* In the foreground extensive use has been made of ornamental shrubs and pink oleanders lend their gay note to many bungalows of the Capital. Scented shrubs like *Murraya exotica* and *Cestrum nocturnum* exhale their perfume in many bungalows. No attempt has, however, been made to vary the planting scheme, and as a result all the bungalows look alike. By adopting different combinations of trees and by planting some of the flowering trees in pure avenues, New Delhi could have been made more colourful. Another defect from which the plantation scheme for compounds of New Delhi bungalows suffers is that fruit trees have been totally ignored, and too much emphasis has been laid on mere ornamentals. Plantation scheme of New Delhi can be very much improved, if fruit trees like grafted mangoes, citrus plants, figs, and papayas compromise between beauty and utility.

Plantation plan for our highways

A plantation plan for our National, Provincial and District Board highways is urgently wanted. In drawing such a plan, climate of a place, its temperature, rainfall, soil and water-level should be carefully considered and suitable species selected.

Avoid mixtures. On account of indiscriminate planting and thoughtless replacements our roadside avenues have become very much mixed. It is very essential that mixtures of different species be avoided and we should have pure avenues of a single species for long stretches. This will not only improve their appearance but also render their management more economic, re-plantation easier and will rationalize their exploitation for commercial purposes. If *mahuas* and *neems* are grown in pure avenues for miles, oil-crushing industry can be easily started in such districts. Due to growth in compact areas there will be saving in transport charges. Similarly furniture-making industry can be encouraged in sub-Himalayan districts which specialize in *sheesham, sal* and teak. Tamarind fruit which now only serves as a staple diet of monkeys, can be profitably exported to Western Pakistan. *Mahua* can be used for the manufacture of power alcohol.

Shade. The main function of a roadside avenue is shade. Hence those trees which are quick-growing and provide dense shade should be selected. The trees selected should provide shade not only at sides, but also in the centre of the road. From this point of view trees with an umbrella or sub-umbrella crown like *neem, mahua, imli* and *am,* are more suitable than trees with a linear, elongated crown like teak, *Eucalyptus* and *Millingtonia.* If these trees provide shade, and also yield valuable timber or fruit, they are still more desirable. The trees should be planted 40 ft. apart so that their crowns may develop freely. Where the road is more than 100 ft. wide a double avenue of trees, with the outer avenue near the boundary line, should be grown. A section of Lucknow-Rae Bareli road has such a double avenue and the road is very shady and cool.

Selection of trees. Trees for various roads should be selected with due regard to rainfall, soil, temperature and water-level. Only those trees should be grown along roadsides which provide thick shade and are also valuable from the economic point of view. The following trees which are shady and also yield products of economic value, are recommended:

Neem (*Azadirachta indica*)
Mahua (*Bassia latifolia*)
Imli (*Tamarindus indica*)
Sheesham (*Dalbergia sissoo*)
Mango (*Mangifera indica*)
Sufed siris (*Albizzia procera*)
Pitheclobium saman (Rain Tree)

Trees unsuitable for roadside avenues. The following trees should on no account be planted along the roadside:

Eucalyptus (all species)
Millingtonia hortensis (*neem chambeli*)
Eugenia jambolana (*jaman*)
Albizzia lebbek (*kala siris*)
Cassia siamea
Ficus glomerata (*gular*)

All these trees are fragile with very weak wood and consequently break easily in a wind-storm. The result is that after a heavy storm roads become blocked and traffic is stopped for a considerable length of time, and during a storm these trees are a positive menace to the lives of unfortunate travellers who happen to be on the road. Besides *Eucalyptus* and *neem chambeli* have linear, elongated crowns which provide poor shade.

Thorny trees. The following trees are thorny and their thorns are a nuisance to pneumatic tyres of small cars, cycles and motor-cycles.

Acacia arabica (*babul*)
Acacia modesta (*phulahi*)
Zizyphus jujuba (*ber*)

Ideal village plantation

Village *shamilat*, the common land which is used for pasturing cattle, is ideal for village plantations. Old fallow land which has been out of cultivation for a long time can also be taken up for plantation purposes. The question is whether these plantations should be raised and managed by individual farmers or by the village *panchayat*. Plantation under the supervision of the *panchayat* and common ownership of the trees is an ideal solution, but the difficulty lies in the lack of corporate sense in many villages. Usually we find that everyone's responsibility is no one's responsibility, and trees planted with great effort are grazed by cattle. So we have to adopt both the remedies. In a village where a *panchayat* is functioning successfully the plantation should be raised by the *panchayat* which can also appoint village young men as guards for protecting the trees for the first two years.

In some villages it would be more feasible to partition the village waste-land into units, one to five acres in area. These plots should be enclosed by *kutcha* walls to give protection to young trees. Where water table is fairly high, a *kutcha* well may also be dug in the plot. Near the boundary wall thorny fuel trees like *babul* or mesquite (*Prosopis juliflora*) may be planted. In the middle area fruit trees like *desi* mango and *kathal* may be planted. The fruit trees may occupy 25 per cent of the area and the remaining should be covered by fuel and timber trees.

Celebrating tree-planting weeks

A 'Land and Development Act' has been passed recently by the Central Legislature for the centrally administered areas of Delhi Province and Ajmer Merwara. Under this Act a Development Commissioner will be appointed who, assisted by a Board, will prepare schemes on many such matters as the preservation and improvement of soil, prevention of soil erosion, development of horticulture and planting of forest trees, control and maintenance of tree growth, and planting or sowing of trees, shrubs and grasses for the purpose of afforesting uncultivable land, etc. If practicable schemes are prepared and implemented with vigour, this piece of legislation will be of great use.

A country, however, cannot be legislated into progress, and the mere passing of an Act does not provide a remedy for a vast problem. The ambitious tree-planting scheme we have outlined requires a nation-wide effort for its implementation. The importance of tree-planting must be brought home to all our countrymen, and by organizing tree-planting drives and weeks the entire nation must be enthused. With this object in view a Tree Planting Week was celebrated in Delhi Province in July, 1947 which was inaugurated by Pandit Jawaharlal Nehru, Sardar Patel and Shri Rajagopalachari. The Week was a great success and all the parks and public gardens of Delhi were planted with beautiful flowering trees whose flowers will lend their grace and beauty to our Capital six years hence. Our main object in celebrating this week to was focus the attention of our people to the natural importance of tree planting. As Mahatma Gandhi commented in one of his evening post-prayer speeches: "The official who originated the idea of tree planting did not do it for fancy, nor was it meant for monied men. It began with them so that others would copy them and thus add to the wealth and rainfall of India". The idea of celebrating Tree Planting Weeks has caught the imagination of the people, and since last year such weeks were celebrated in many provinces. Planting of trees is regarded as an act of virtue in India, and as the trees we have planted grow up, they will remind our younger generation of the message of a nineteenth century poet:

He that planteth a tree is the servant of God,
He provideth a kindness for many generations,
And faces that he hath not seen shall bless him.

Book Reviews

POTATO

By W. G. Barton. (Published by Messrs. Chapman & Hall, London, pp. 319, 25s.)

THE potato now occupies a prominent place in the world food economy; its total world production exceeds that of wheat and rice. The position, second only to cereals, which the potato has won for itself, is ascribed to several different causes, not the least important of which is its intrinsic merits as food. Besides being mainly a starchy food—a crop of potatoes yields about twice the quantity of starchy food as wheat or rice from the same plot of ground; potato contains considerable amounts of protein, minerals and vitamins B and C. It has, however, certain disadvantages. It is not an ideal food to transport; it is readily bruised and in consequence suffers considerable loss during transport and storage. It is subject to several diseases, particularly the virus diseases, which take a heavy toll of the yield. A great deal of research work has been done on this crop, since its first introduction into Europe from South America in the sixteenth century, and there is a considerable volume of literature dealing with the various aspects of its production and utilization. W. G. Barton, in this book, has summarized the available information dealing particularly with 'the yield of the crop as influenced by various factors such as the climate, soil, manuring and varieties'. He has also discussed at length 'what proportion of this yield consists of potentially nutritive matter, and what factors influence this proportion, its composition, its loss during cooking and the quality of the cooked tubers'. The question of storage of potatoes from the point of view of eliminating losses and retaining the nutritive value of the tubers, has also received his attention. This book is a valuable addition to our knowledge of the potato as a source of food and should serve as a guide to all those interested in furthering its use as such.

The book is divided into ten chapters. The first chapter deals with the introduction of the potato from its original home into the European countries, the history of its development in British Isles, its annual production and consumption. Chapter two briefly outlines the origin of the varieties, the bases of their classification and the characteristics of a few important varieties. The succeeding four chapters, which form an important section of the book, discuss the question of yield and dry matter content of the potato as influenced by seaon, soil, cultural and manurial practices, variety and disease. Throughout emphasis is laid on the complex interaction of these factors in influencing the yield. In chapter seven, the analysis of the tuber is discussed with reference to its structure, composition and proportion of its constituents. Chapters eight and nine deal with the nutritive value of the tuber as judged by the extent to which the various constituents are digestible and the proportion lost during the process of preparation and cooking. The criteria of quality of the various forms of cooked potato are also given. The methods of storage are discussed in detail in the last chapter in relation to its effects upon nutritive value and culinary quality. Reference is also made to the uses of potato other than for human consumption in an appendix.

The book consists of 270 pages of easy reading matter with a number of useful tables, diagrams and a few plates. There are also three appendices and an author index, an index of potato varieties and a subject index at the end of the book. Relevant references to literature are given at the end of each chapter. (S. R.)

News and Views

CENTRAL ARECANUT COMMITTEE CONSTITUTED

THE Government of India have decided to set up a Central Arecanut Committee for the improvement and development of the production and marketing of arecanut and its products. The Committee will consist of the Minister for Agriculture, Government of India, as President and the following members: The Agriculture Commissioner and the Marketing Adviser, Government of India; a representative each of the Ministeries of Finance and Commerce to be nominated by the Central Government; four members of the Dominion Parliament who are neither growers of nor traders in arecanut who will be nominated to represent consumers; eight members representing arecanut growers of whom four shall be nominated by the Government of Madras, one by the Governments of Travancore and Cochin and one each by the Governments of Bombay, Assam and Mysore; seven persons representing the Departments of Agriculture of Assam, Bombay, Coorg, Madras, Mysore, Travancore, Cochin and West Bengal to be appointed in each case by the Government concerned, and six persons representing the trade in arecanut, one each being nominated by the Government of Madras, Mysore, Travancore and Cochin, the All-India Supari Federation, the Federation of Indian Chambers of Commerce and Industry and the Palghat Chambers of Commerce.

Inter alia the Committee will assist and encourage agricultural, industrial, technological and economic research in arecanuts; produce, test and distribute improved varieties of seed; encourage the adoption of improved methods of cultivation; assist in the control of parasites and diseases which affect arecanut; encourage the adoption of improved measures for arecanut marketing; give financial and technical assistance to organizations engaged in growing, processing, grading and marketing arecanut, establish a market intelligence service and recommend maximum and minimum prices to be fixed for arecanut and the controlled purchase and distribution of arecanut imports.

The Government of India will give an annual grant to the Committee not exceeding Rs. 5 lakhs and will appoint a Secretary and Cooperative Arecanut Marketing Officer to assist the Committee.

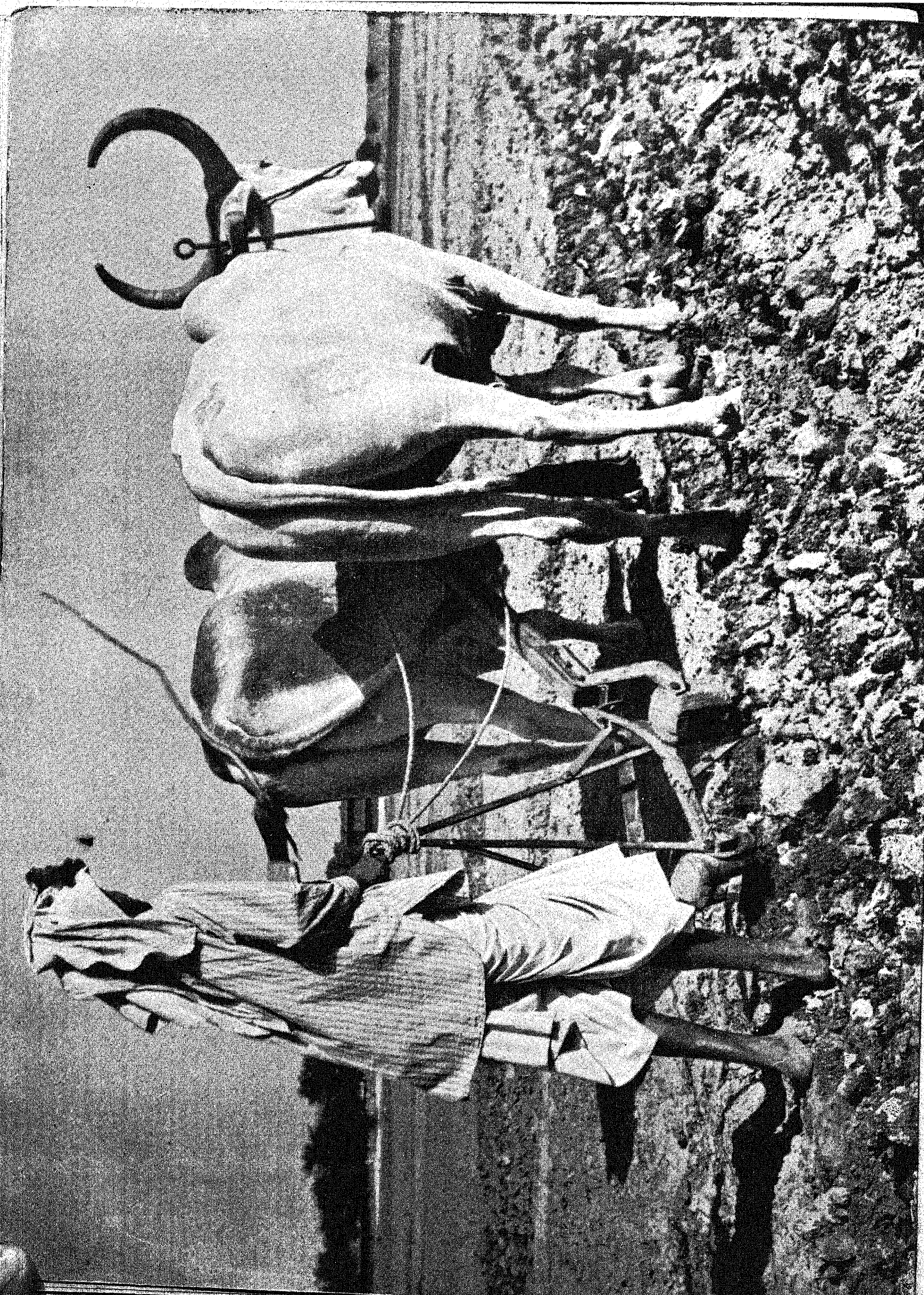
The establishment of the Central Arecanut Committee follows the recommendations made by an *ad hoc* committee set up by the Indian Council of Agricultural Research in 1946, which considered the preliminary measures necessary for affecting improvements in the arecanut industry. The Central Government had been receiving numerous representations from individual producers and arecanut associations in South India on the difficulties facing the industry. These were: Lack of scientific research to improve the cultivation and production of arecanut, the ravages of diseases and the ill-developed marketing methods in existence. The possibilities of cheap and heavy imports of arecanut from the Strait Settlements, Ceylon and other areas in South-East Asia, and their depressing effect on the prices of the indigenous variety were also stressed, and it was suggested that there should be some control to regulate the marketing of the Indian and the imported varieties.

Madras is the largest grower of arecanuts in India with 107,000 acres under this commodity and Coorg the smallest with 800 acres only.

The Hon'ble Shri Jairamdas Daulatram, India's Agriculture and Food Minister, who is the President of the newly constituted Arecanut Committee, has appointed Mr. K. Madhava Menon, Minister of Agriculture, Government of Madras, to be its first Vice-President.

PLATE 38

The new plough evolved by the Indian Agricultural Research Institute.



IMPROVED TYPE OF PLOUGH EVOLVED

THE Indian Agricultural Research Institute of the Central Ministry of Agriculture has evolved a new plough which with a single pair of bullocks is capable of doing twice the work done by the normal *desi* plough.

The new plough is simple in construction and consists of the bottoms only of two standard *desi* ploughs, suitably coupled by means of an iron framework and pulled by a single central beam. The ploughs are so spaced that identical furrows are cut and they carry out in one operation that much of work which would be performed in two operations by the standard plough.

The new plough is comparatively light, its weight being approximately 50 per cent heavier than the *desi* plough. Trials given to the plough in the Agricultural Research Institute showed that the draft did not exceed 260 lb. as against the normal draft of 155 lb. of a *desi* plough. The additional draft of the new plough is not likely to be heavy for bullocks as experience has shown that so far as ploughing is concerned bullocks are usually underloaded. Tests carried out at the Institute show that an ordinary pair of bullocks can operate this double plough without undue extra effort. The output of work and the quality of ploughing will also automatically be improved. Seasoned ploughmen who have used the new plough are enthusiastic about it and state that it is easier and less tiresome to operate due to its stableness when in work.

Besides its simplicity in construction the new plough is comparatively economical—a consideration which is particularly important for the people who will use it. Compared to its capacity of doubling the output of work, the cost of construction is not more than 50 per cent of that a single plough and the machine can be easily repaired or even constructed by the village blacksmith or carpenter.

I.C.A.R. ENQUIRY ON MEDICINAL PLANTS AND FOOD POISONS

A SCIENTIFIC enquiry, extending over a period of 12 years, on Indian medicinal plants and food poisons which was launched under the auspices of the Indian Council of Agricultural Research in 1935 has now been completed and Col. R. N. Chopra, at present Director, Drugs Research Laboratory, Srinagar, who conducted the enquiry has submitted his final report to the Council.

Publication of a monograph on poisonous plants in India, establishment of a herbarium of medicinal and poisonous plants, preparation of an Indian Pharmacopœia and encouragement to the cultivation of medicinal plants in the country are some of the tangible achievements arising out of the scheme. Besides, the results of the enquiry have also been of considerable assistance to the establishment of the Central Drug Research Laboratory at Lucknow.

The Report says that the enquiry has definitely advanced the knowledge with regard to pharmacopœial and allied drugs in India. A number of firms manufacturing drugs from Indian medicinal plants have come into existence and, instead of depending on concentrated extracts from foreign countries, practically every kind of galenical powder extracts are now being manufactured in India from materials produced in the country.

India is the emporium of all kinds of medicinal herbs and drugs and, with suitable facilities, she can produce not only enough for her internal requirements but also considerable quantity for export. The enquiry has stimulated cultivation of medicinal plants. Among drugs which have been brought into extensive cultivation may be mentioned belladonna, digitalis, hyoscyamus, colchicum, gentian, ephedra, pyrethrum, etc.

Poisonous plants of which there are a large number in India and which are constant danger not only to animals but even to human beings have been studied and a much needed warning against their indiscriminate use by the unqualified practitioners of indigenous systems of medicine has been sounded. Some food poisons of this country such as *khesari dal* (*Lathyrus sativus*), Indian millet (*Sorghum vulgar*) and *sialkanta* seeds (*Argemone maxicena*) which have been responsible for producing serious outbreaks of food poisoning among men and animals have been studied. However, only fringes of this vast problem have so far been touched and much more work remains to be done.

A monograph on poisonous plants of India has been prepared in two volumes of which the first volume is expected to be published shortly.

A herbarium on medicinal and poisonous plants in India has been established. This contains about 1,730 species of medicinal plants out of about two thousand found in India. This herbarium is consulted by scientists, medical practitioners, pharmacy students and industrialists.

ERRATA

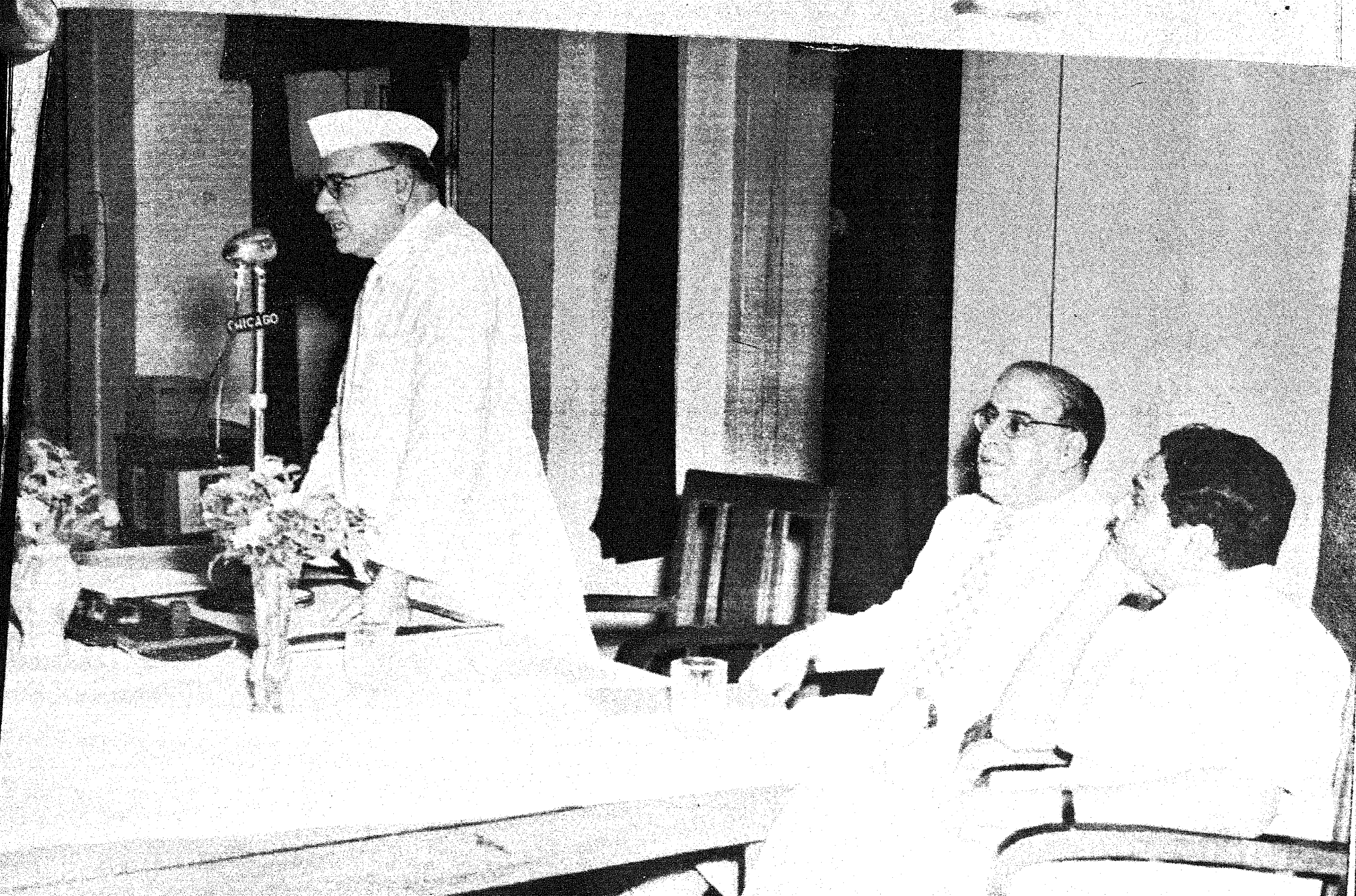
Indian Farming, Vol. X, No. 5, May 1949: Page 189, Col. 1 line 37, *for* 'Degree of Science' *read* 'Degree of Doctor of Science.'

Page 190, Col. 2 line 3, *for* 'persons of India' *read* 'persons in India': line 24, *for* 'His was the life' *read* 'His was a life.'

PLATE 39

The Hon. Shri Jairamdas Daulatram addressing the Second Annual Convocation for the award of diplomas to the students of the Statistical Training Course of the Indian Council of Agricultural Research held at New Delhi on May, 1949.

Seated at left of the Hon. Minister are Mr. K. L. Punjabi, Secretary, Ministry of Agriculture and Shri S. M. Srivastava, Joint Vice-Chairman, I.C.A.R.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THE TASK BEFORE STATISTICIANS*

WHEN I find in front of me such a large assembly of statisticians, I ask myself whether I am in any way qualified to address you. Probably the only reason why I am asked to address you is that I happen to be one of those who represent free India in the governmental sphere. Free India has had to deal with many tasks and free India will have many more equally big tasks to handle in the future. One of the big tasks which free India has to handle is to increase India's agricultural production to the maximum extent possible. When a country is inhabited by as many as 35 crores of men and when out of these 35 crores roughly 80 per cent live in the rural areas and most of this 80 per cent depend directly and indirectly on agriculture, the position which agricultural development has to occupy in such a country can only be of the topmost priority. For more reasons than one, India has to attend to its agricultural development. Let us take the important question of raising the standard of living of the people. We all know that our masses residing in the villages live on the land and all their prosperity or their poverty is linked up with what their land produces. If the masses have to increase and improve their standard of living, they can only do so if they have the purchasing power to do so. Therefore, the standard of living of our agricultural masses can improve only when our land produces much more than it does today. This increased production will place in the hands of the agricultural masses greater purchasing power with the aid of which they can raise the standard of living. So also linked up with agricultural development is our industrial development. India's industries, if they have to develop to the utmost, must find the purchasers of industrial products among the masses of India. From many points of view, apart from the point of view of the contentment of the agricultural masses, it is recognized that we should produce far more from the land than we do today. All this means very careful planning and speedy implementation of those plans. But planning is impossible unless we have facts before us. We cannot plan in a way which is out of touch with the realities of the situation. It is here that the science of statistics comes to our aid. It constitutes the light which enables us to see the path on which we are treading. Let us take a simple question; let us take the question which probably some of you have studied. One of the biggest crops in this country is wheat. To protect our wheat we are trying to evolve rust-resistant varieties. We can only do so by experiments in the field and it is for you to assess the results of those experiments. But without the statistician we are likely to go astray. It is the statistician who knows as to what exactly we have to do, which variety of wheat evolved in the laboratory sown under what conditions, in what quantity, in what texture of the soil, irrigated with how much water and subject to which other varying conditions is to give us the maximum yield. All these are matters which statisticians examine carefully and so plan correctly and estimate the results accurately. I do not want to go further into these technicalities but I wish to stress the point that a statistician can be very helpful in the proper planning and execution of agricultural programmes in this country.

You have been trained in an Institute which has not yet come to occupy the place which it merits. Hard work is being done in this

*Address by the Hon'ble Shri Jairamdas Daulatram on the occasion of the I.C.A.R. Convocation, held on 4 May, 1949, for awarding diplomas to the statistical trainees.

Institute in a plain building in unostentatious surroundings under the direction of Dr Sukhatme, who occupies an important place in the international circle of statisticians. His unassuming appearance may not help you to realize how high is his reputation in the world of statisticians.

India is faced with many big tasks and it is the duty of everybody that free India should be able to fulfil each big task. One particular task which has relationship with our statisticians, one big venture, one big challenge which Government have set before themselves and before the whole country is that by 1951 we shall liberate India from the bondage of foreign food. And statisticians have quite a responsible and big part to play in the achievement of this task. The correct planning as to what should be done, the correct estimate of the results of what has been done, all this will be your task. I, therefore, appeal to all of you that apart from any personal considerations, let this national consideration inspire you to feel that among the thousands and lakhs of other workers who have to participate in this great task, you also will have an important part to play. You will help to determine our plans, you will help to implement those plans and you will help to estimate the results of those plans. I hope this spirit will continue to guide you not only during these two years but so long as you remain and function as statisticians.

Original Articles

ROMANCE OF THE REBORN SUGAR INDUSTRY IN INDIA*

By T. S. VENKATARAMAN

THOUGH it is widely known that the Benares Hindu University owes its origin to our revered leader, Pandit Madan Mohan Malvyaji, it is within the knowledge of only a few that the rebirth of the Indian sugar industry was also initiated by Panditji. It was he who drew the attention of the Government of India to the deteriorating position of the home industry caused by imports of cheap white sugar from Java. At the instance of the legislature, the Central Agricultural Board initiated work in two directions. One was on the manufacturing side and consisted of trying to evolve a unit in between the modern sugar factory and *gur* manufacturing methods. To the Station at Coimbatore was entrusted the task of producing improved sugarcanes for the country. This is because the canes in cultivation over the bulk of India were easily some of the poorest in the world.

New canes

In view of the fact that canes imported from other countries were mostly failures, the station at Coimbatore attempted to produce new canes within the country by suitable breeding. At that time the opinion was strongly held both in India and outside that sugarcanes did not produce fertile seeds under Indian conditions. The first sugarcane seedlings that germinated were too carefully grown and under such artificial conditions that most of them died out. An attempt was therefore made to germinate the seeds in the open and under natural conditions exposed to both the sun and rain of India. This resulted in quite a large number of germinations which gave the suspicion that they were all only grasses and not real sugarcane seedlings. The order was therefore given that they should be destroyed to prevent discredit to the attempt. Fortunately, however, a holiday intervened between the order and its execution. This enabled a reconsideration of the matter and it was decided to keep the seedlings for a couple of months but removed from public view. If ordinary grasses they would show themselves up by the time. The wells in Coimbatore are very deep and the seedlings found a lodging in the berm of these wells hidden from public view. These plants, which later proved to be genuine sugarcane seedlings, were thus born and grew under some form of imprisonment. This reminds one of the manner in which great men were ushered into this world. Lord Jesus was born in a manger and Lord Krishna in a prison.

When the Indian Sugar Committee of 1920 visited our chief source at that time of white sugar, namely Java, both information and plant material were freely given to India as it was thought at the time that India could never count in the white sugar world. It was then more than half a dozen years since the Coimbatore station was started on a temporary basis and its productions were beginning to show some promise in the experimental plots of certain provincial stations. Even so, the committee which contained men of knowledge and experience made bold to recommend the continuance of the Coimbatore attempt.

Productions from Coimbatore

The productions from Coimbatore had many vicissitudes during their infancy and childhood stages. Being on a temporary basis the retrenchment committee constituted at the time by Government to effect economies naturally paid its first attention to Coimbatore. Fortunately, however, the canes from Coimbatore, though yet grown only in small

* Summary of a popular lecture delivered by Dr T. S. Venkataraman at Walchandnagar, on 10 February, 1949 on the occasion of the Eleventh Meeting of the Indian Central Sugarcane Committee.

plots, had attracted the attention of a group of sugar factories in Northern India under European management. This was because of the enthusiasm of the Sugar Bureau under Mr. Wynne Sayer who was able to get grants from the factories for expanding this work. As hard headed businessmen had placed belief in the possibilities of the Coimbatore attempt, it was easy for the Government of India to continue the station though for short periods and on temporary basis.

At that time certain of the scientists at Pusa had developed a hostile attitude to the Coimbatore productions. The now famous Sir Albert Howard opined that the flowering of the Coimbatore canes showed weakness. He also mentioned that the higher yields would quickly impoverish our soils. Mr. G. Clarke who was in-charge of the most important sugarcane station in the U.P. pinned his faith in the Java canes which he had imported and which he was pushing into the cane belt. He felt that Coimbatore could not come up to the level of the Java canes and therefore practically banned the cultivation of Coimbatore cane near his station. Perhaps, the first favourable report of Coimbatore work came from distant Cuba where Co. 281 was found to be a useful cane. The factory at Nellikuppam in South India came to know of this and obtained planting material of this cane from Coimbatore.

Apart from the above there existed a popular prejudice against these productions because they were new. Some North Indian cultivators thought that because of their flowering the Coimbatore canes would ultimately develop weakness. It was even believed at the time that *gur* from Coimbatore canes would cause impotency.

Amidst these gloomy environments credit is due to the first Tariff Board which definitely realized that there was some possibility in India to develop a strong home industry. It has to be remembered that at the time the Coimbatore productions were practically confined to experimental plots in Government farms. The Coimbatore canes soon spread into cultivation and easily established their superiority in the grower's fields. Planting material of certain of these canes were even stolen from experimental stations and one such cane, rejected by the Experiment Station at the time, served the industry in a remarkable way for some time. This shows that when an improvement is real it does not take much labour to put it across to the Indian cultivator.

The Coimbatore productions soon came to be known in the other sugarcane stations of the world and indents began to pour in from other sugar stations on the basis of exchange of material. Today, the Coimbatore productions have shown their use in many parts of the world from Cuba and Peru in the West to Australia in the East. In fact, the Coimbatore work came to be known in the other parts of the world earlier than most other achievements of the Agricultural Departments in the country.

Basic factors

If one were to examine the basic factors on which the Coimbatore work was built up these may be summarized in three words: sincerity, boldness and high endeavour. From the very commencement the persons in charge of Coimbatore work concentrated their sole attention on only one object namely, the production of improved canes for India. Secondary issues of however great scientific interests were religiously eschewed to conserve the energies of the station for the main work set before it. This aspect, research with a definite aim, is very important for real scientific advance. Unfortunately, this is not always realized in the country. Again, the Coimbatore scientists pursued in their endeavour new and bold lines in their scheme of hybridization. The programmes followed were frowned upon by orthodox text-book scientists. Today the Coimbatore sugarcane station has got a range of parent material comparable and, in some cases, superior to the other sugarcane stations of the world. For success in the future the station needs a personnel with high enthusiasm and boldness to follow up the new and novel lines of hybridization laid down during the past three decades of its existence, and freedom to carry on its work unhampered by official red tape and all that it connotes.

MANUFACTURE OF PALM CANDY

By S. C. ROY and B. C. JOSHI

WITH the introduction of prohibition in certain palm-growing provinces of the country, attention of the Central Government as well as the public is being diverted to the development of the age-old cottage industries of palm *gur* and palm candy manufacture in India. So far, a large quantity of palm juice was being used for alcoholic fermentation and the fermented product had become a regular commodity in trade. This juice has now to be converted into crystallized sugar using improved processes and equipment. A separate department devoted solely to the development of the indigenous industries of palm jaggery and candy manufacture has been started under the Palm *Gur* Adviser to the Government of India. This department has started many research centres all over India and the development work is in full swing.

India is the largest palm sugar producing country in the world. The average annual production being about 174 tons[1]. Palm sugar or candy making industries are mostly located along the coast line of the country where palms thrive best. There are many varieties of palms growing in India, but only a few varieties yielding higher percentage of sugar are used for the manufacture of palm jaggery. A good bit of this jaggery undergoes a refining process and turned into palm candy.

In view of the importance of the subject, a study of the indigenous processes of palm candy manufacture, as practised in certain parts of West Bengal, was taken up and experiments were undertaken to effect improvement in the plant and process of manufacture of palm candy from palm jaggery.

Indigenous method of palm candy manufacture

The process was studied at the spot during a visit to a palm candy manufacturing concern at Calcutta. A sample of the jaggery was brought from Calcutta and analysed. It had the following composition :

Brix.	Pol.	Py.	*p*H.	Red sugar	Ash
89·01	71·20	79·99	6·1	5·078	3·00

Ordinarily the jaggery is poured into gunny bags which are hung by hooks to drain off the liquid substance from it. Later these bags are pressed to drain out adhering molasses. The sugar so obtained is somewhat lighter in colour. This is dried and stored.

This sugar from palmyra palm jaggery is melted in an iron pan over an open-fired furnace. Clarification is effected by adding diluted milk and skimming off the scum. At this stage, some Hydros is also added to it to improve colour. Strike temperature is judged by means of the ' thumb method. ' The concentrated liquor is transferred to *tals* and kept for crystallization for about a week. These *tals* are similar to those used in sugar candy manufacture. After the crystallization is over, the *tals* are punctured and the mother-liquor is drained out. Draining goes on for two or three days. During this time the candy is also dried. It is taken out from the *tals* and cut into small pieces, packed in bags or tins and sold. The total yield of candy is only about 20 per cent on the weight of jaggery.

The drained mother-liquor is further concentrated and kept into drums for crystallization. After three or four days the crystallization is complete, and small dark crystals are formed inside the mass. These crystals are separated from the mother-liquor by straining through gunny bags. The crystals so separated are mixed with the original palm sugar and boiled off for another crop of candy.

The mother-liquor drained is unfit for any further candy crop. A sample of this mother-liquor was brought from Calcutta and analysed. It was found to have the following composition:

1. *Report on the Marketing of Sugar in India and Burma*, **1943.** Marketing series No. **39.**

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Brix.	Pol.	Py.	pH.	Red sugar	Ash
76·45	56·80	74·29	6·0	10·58	3·80

This is either sold away to tobacco manufacturers for blending it with tobacco or used along with coal-tar for painting roads, etc. Some licentiate distillers use this mother-liquor for the manufacture of alcohol as well.

Improving the quality of palm sugar from palm jaggery

With a view to introducing improved methods for the manufacture of palm candy, it was proposed to conduct a few experiments on the manufacture of a better quality of palm sugar than that usually taken out from palm jaggery.

Palmyra jaggery was obtained from the Agricultural Officer, Ellore. The jaggery was almost solid and had a very dark appearance. It had the following composition:

Pol.	...	82·40 per cent
Sucrose	...	78·43 „ „
Glucose	...	3·02 „ „
Moisture	...	5·66 „ „
Ash	...	1·97 „ „

The following experiments were conducted with the jaggery mentioned above:

Clarification: A melt of 70° Brix of the above jaggery was prepared and treated with different proportions of milk, carbon, phosphoric acid and alumina cream. The treated melt was boiled and filtered. The filtrates were analysed for colours. The results are tabulated in Table I.

TABLE I

Classification of palmyra palm jaggery melt. Brix.—70°. 100 c.c. melt was taken for treatment in each set.

Set No.	Treatment	Colours (reading taken in $\frac{1}{16}$ in. cell)				Observations
		Y.	R.	B.	*Total*	
1	Control	13·9	4·6	0·3	18·8	Very dark and turbid
2	Melt—1 c.c. milk	11·8	3·4	0·1	15·3	do.
3	Melt—5 c.c. milk	10·3	3·2	0·1	13·6	Dark and a bit turbid
4	Melt—1 gm. carbon—2 c.c. milk	10·0	3·0	–	13·0	do.
5	Melt—2 gm. carbon—2 c.c. milk	10·6	2·2	–	12·8	Lighter but a bit turbid
6	Melt—5 c.c. alumina cream—2 c.c. milk, 1 gm. carbon	9·8	1·7	–	11·5	Lighter but not very clear
7	Melt—100 c.c. alumina cream	8·2	3·8	–	13·0	do.
8	Melt—50 c.c. milk	6·6	1·6	–	8·2	Much lighter and clear
9	Melt—1 drop of H_3PO_4—1 gm. carbon	5·2	1·8	–	7·0	Clear and bright

As a matter of fact the melt was very dark. It was not advisable to dilute it further because of higher fuel consumption. The lightest filtrate was obtained with set No. 9 when one drop of phosphoric acid and 1 gm. of carbon were added to 100 c.c. of melt. It will be seen from the results that better clarification of the sample of jaggery was difficult.

Crystallization of sugar from palmyra jaggery: Palmyra jaggery was melted over steam in the melting pan. Clarification of the melt was effected by using 4 per cent carbon, 2 per cent milk and a little superphosphate solution. Analysis of the melt was as below:

Brix.	Pol.	Py.	pH.
76·70	68·35	89·11	6·6

One per cent Hyflo was used as filter aid and the melt filtered through a filter press. The filtered liquor was concentrated over steam to a concentration of 83·70° Brix. The concentrated mass was transferred to a Magma-mixer where it was cooled and stirred.

After about two hours' stirring, the mass was purged in a centrifugal and the crystallized

sugar was separated. The molasses which separated out had the following composition:

Brix.	Pol.	Py.
66·45	54·75	82·39

The sugar so obtained was of a light brownish colour. It was of the following composition:

Pol.	...	96·2	per cent		
Moisture	...	0·943	,, ,,		
Invert sugar	...	1·730	,, ,,		
	Y.	R.	B.	*Total*	
Colours	28·4	6·0	0·4	34·8	(½ in. cell)

The sugar so made was used for the manufacture of palm candy as described below.

Manufacture of palm candy

The sugar was melted in a melting pan and the melt clarified using 1 per cent carbon and 2 per cent milk. The treated melt was filtered through a filter press. The filtrate was analysed and found to have the following composition:

Brix.	Pol.	Py.	*p*H.
71·40	67·58	94·66	6·8

The filtrate was concentrated over steam to different concentrations and transferred to *tals* for crystallization. After a duration of eight days the *tals* were drained and the candy examined. Results have been tabulated in Table II.

TABLE II

Crystallization of palm candy

Maximum temp. °F.	Minimum temp. °F.	Humidity
84·2	55·7	64·00

Set No.	Strike temperature °C.	Analysis of concentrated syrup			Yield of candy	
		Brix.	Pol.	Py.	Percentage of yield	Quality
1	108	80·00	74·97	93·72	26·3	Too poor, very small crystals, colour dark
2	109	81·44	76·75	94·24	30·4	Poor crystals, a bit bigger, of darkish colour
3	110	82·50	77·68	94·16	35·0	Medium sized crystals, darker
4	111	83·72	78·59	93·88	38·4	A few well formed bigger crystals, good top layer
5	112	85·00	80·11	94·25	37·8	Good general crop, closely compacted

It will be seen from Table II that candy in all cases was rather dark. This was chiefly due to the bad quality of the jaggery. Lower concentrations did not give good yield of candy. Maximum yield was obtained from a strike temperature of 111°C. Compared to the strike temperature in case of sugar solutions, this temperature was 1·5°C. higher. This higher temperature might be due to the non-sugar content of the jaggery itself.

The candy obtained was dried and cut to pieces. The average analysis of the candy obtained is given below:

Pol.	...	97·50 per cent
Glucose	...	0·266 ,, ,,
Moisture	...	0·619 ,, ,,
Ash	...	0·188 ,, ,,

Flow diagram for palm candy manufacture

On the basis of the above experiments a flow diagram as shown in Fig. 1 is given. The process consists of:

(a) Melting the jaggery in a melting tank of suitable capacity. Brix. of the melt to be adjusted to 70°C.

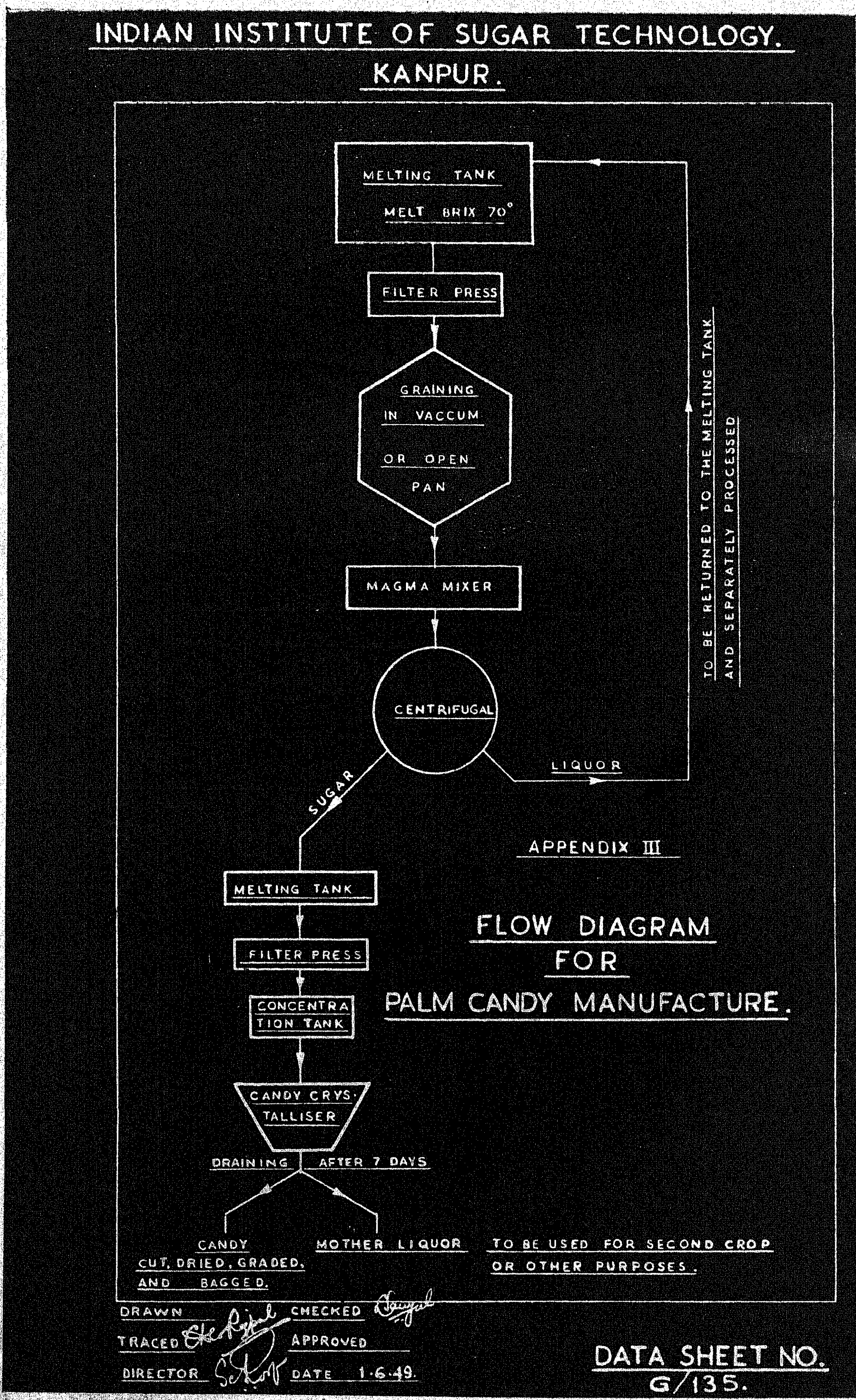

FIG. 1. Flow diagram for palm candy manufacture.

(b) Clarification of the melt using adequate quantities of activated carbon and milk. The quantities will depend on the quality of the jaggery. Hyflo to be used as filter aid.

(c) Filtration of the melt through a plate and frame type of filter press.

(d) Concentration of the clarified liquor over steam preferably under vacuum to a concentration of 80° to 82° Brix. (If vacuum pan is used the liquor is to be grained to a massecuite).

(e) In the absence of a vacuum pan the concentrated liquor to be grained in a water jacketed Magma-mixer.

(f) The massecuite so formed to be centrifuged in a centrifugal and the sugar washed.

(g) The sugar to be melted in the melting tank, clarified and filtered.

(h) The filtered liquor to be concentrated over steam to a concentration of 82° to 84° Brix.

(i) The concentrated liquor to be transferred to crystallizers.

(j) Crystallizers to be drained after seven days and candy separated, dried and bagged.

(k) A second crop of candy if desired to be taken from the mother-liquor after due clarification, etc.

Utilization of the palm candy mother-liquor

Manufacturers using the indigenous system of palm candy manufacture usually sell the mother-liquor to tobacco manufacturers for blending with tobacco. Some use it for the manufacture of certain varieties of sweets.

Experiments were conducted at the Ravalgaon Centre to device ways and means for a better disposal of the mother-liquor. As a result of a series of experiments it has been found possible to convert the liquor into a type of syrup which very closely resembles honey. In countries like Brazil where palm candy is manufactured on a large scale, the whole of the mother-liquor is usually converted into what they call 'palm honey'.

WASTE PRODUCTS OF COFFEE

IT was known for a long time that the pulpy residue from the coffee bean was a good feed for cattle. It remained a waste product for the simple reason that cattle did not like the taste of it and therefore would not eat it. At a cooperative experiment station in El Salvador, American and Salvadorean researchers, by experimenting with additional ingredients, evolved a formula that made the material palatable to milk cows. The waste material can now be used as a substitute for corn. If all the coffee pulp in Latin America were converted to cattle feed, a not impossible task, it would provide the equivalent of about 34 million bushels of corn a year. Such an achievement would be significant for both the health and the economies of the Latin American countries, which are now producing only a small percentage of the milk their peoples need. *Technical and Scientific Cooperation Bulletin, Public Affairs Department of State, U.S.A.*, February 1949.

FRUIT FOR THE MILLIONS

By MURARI PROSAD GUHA

NATURE'S nursery is in the tropics, the region of colour, warmth and sun- shine, and the best for vegetation. Some of the best fruits of the world are to be found here and banana is one of them. This cheap- est and possibly the best fruit of India is being cultivated here from the dawn of civilization; the Ajanta frescoes (443 B.C.) depict the fruit in high state of cultivation.

Decandolle[1] records that banana is cultiva- ted for more than 4,000 years in tropical Asia and its antiquity and wild character are indisputable facts, there being a good many sanskrit names. The botanical generic name *Musa* is derived from the Arabic *Mouz* or *Mouhoz* as sages ate its fruit and reposed beneath its shade.

Origin and geographical distribution

Although, as has already been said, the natural home of banana is in the tropics, wild and cultivated varieties have made themselves at home in sub-tropical regions, and even in cooler regions as in the Himalayas, where it is found in the wild state even at 4,000 ft. to 6,000 ft. and is cultivated at 7,000 ft. above sea-level. It has spread all over the tropical world probably from its original home in India or Malaya and today it is grown throughout the warm regions, except the desert areas which are too arid.

Banana found its new home in Africa probably earlier than it was carried to the land of Arabian nights. Probably it spread to the islands of the Pacific before any explorer visited them.

But the present mass production of banana in the West Indies and tropical America had its origin from Canary Islands, where the plant reached in 1516 A.D.

Important varieties

The two most important varieties, from point of view of utilization are *paka kala* (banana) and *kacha kala* (plantain), the former eaten raw and the latter eaten after being cooked. All our Indian varieties are confined to only one sub-species *sapientum* under the species *Musa paradisiaca*. The dwarf form (*Musa Cavendishii*), known as *Singapuri kala*, is very popular throughout India, differing from the others in that it loves a cooler climate and the fruit when ripe remains the same pea-green in colour.

The most outstanding variety in the whole world is the Gros Michel, a tall tree with long, comparatively slender recurved yellow fruit with strong stem. This variety alone domi- nates the whole of the tropical American plantations as well as those of the Pacific Islands and bananas worth about $50,00,000 are shipped from these regions yearly.

The most important provincial varieties are: Sabri or Martaman and Champa in West Bengal; Poovan and Nendan in Madras; Basrai and Tambadi or Tambeli in Bombay; Champa in Assam; Anpan and Chinia or Chunia Kela in Bihar; Palampodan and Yethen in Travancore; Rasabale and Salam- bale in Mysore.

The varieties Martaman and Lalchal in West Bengal and Bombay respectively as well as the hill bananas of Madras are rather costly and are generally preferred by the rich.

Why cultivated

It has been estimated[2] that the total area under banana and plantain is about 20 per cent of the total area of two million acres under all fruits in India and next to mango which has the highest acreage of all fruits. Of all the provinces Madras has the maximum acreage, next comes West Bengal, although due to partition the major area has gone over to Eastern Bengal. The present acreage in West Bengal might be more or less some 50,000 acres. As is revealed by available statistics banana gives the maximum yield per acre (being highest in West Bengal yielding 500 maunds per acre)[2] and as such can support a greater number of people, the units of

[1] Decandolle, Alphonse (1884), *Origin of Cultivated Plants*, p. 304.

[2] *Report on the marketing of Bananas in India* (1945)- Central Agricultural Marketing Department, India.

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calorie produced per acre being highest than a similar area of any other crop under the most favourable conditions. Moreover, this huge produce can be preserved indefinitely by preparing meal from the dried fruit without affecting the food value.

The available quantity for consumption *per capita* in India was 22·9 lb. (loc. cit. 2) annually (15·2 lb. in England—all imported), this being highest in Bengal (87·1 lb.) and lowest in U.P. (0·5 lb.). Unfortunately this fruit does not reach the millions in our country though in the last few years the production *per capita* has increased considerably.

The young innermost leaf of banana is used as a dressing for burns as well as for covering boils and blisters. From *Ayurvedic* point of view plantain curry is a recipe for bowel troubles and the roots and stems are tonic, antiscorbutic and useful in disorders of blood.

Description of the flower

The flower is trimerous and the inferior ovary carries on it the irregular perianth in two parts, one called the *perigonium* representing five perianth lobes, and the *scale*, representing the sixth. Besides the usual five stamens, the sixth rudimentary or fully developed one is also found sometimes. Of the gyneocium, the ovary is tricarpillary and syncarpous, one style and single stigma with undulating surface. In unusual cases, the number of styles is three. Transitional stages are also found.

Fruiting time

The average time taken to bear the first crop of fruit is 10 to 12 months after planting, though there is a great variation in fruiting time among the different varieties or even among individuals of the same variety, the minimum being six months and the maximum 14. At maturity the inflorescence emerges from the rhizome through the pseudo-stem and large number of flowers are closely crowded in the axils of the bright protecting bracts. The inflorescence bends over and when a sufficient bunch of fruit has set, the pendant extremity (*mocha*—used as vegetable) with the remaining unopened flowers and bright bracts, should be cut away to give better scope for the remaining fruits to develop, which in most cases are seedless. The *Singapuri* banana takes the maximum time for fruiting, viz. two to three years. Usually at intervals of five months or a little more the successive crops are secured.

After full growth and ripening the bunch of fruits is severed and hung up in a dark warm place for further ripening and the plant is cut and removed to give room for the development of the young suckers. The stalk of the inflorescence (*thor*), coming from the rhizome through pseudo-stem, is utilized as vegetable.

Number of fruits in a plant and yield per acre

The number of fruits varies among different varieties, though it much depends on soil condition and manuring, the minimum being 50 in a bunch and the maximum 200. Annually the average yield per acre in India is 155 maunds[2]. In Bengal the yield per acre is 500 maunds; Mysore gives the lowest yield being 35 maunds only. Other provinces give the following yields: Assam—200 maunds; Madras—160 maunds; Bombay—135 maunds; Bihar—90 maunds; and Travancore—49 maunds.

Food value of the flesh of the fruit

The value of the banana fruit has already been realized from the fact that it produces maximum calories per acre. Barnell[3] even goes so far as to say that 24 bananas (presumably large ones) with milk, would provide a balanced diet for an dult doing no manual labour. However, a comparative self-explanatory chart adapted from Datta[4], of the best two fruits of India is given below:

Protein	...	0·15	0·1
Fat	...	01·7	0·1
Starch	...	18·2	7·9
Vitamin A		**	*
Vitamin B		—	*
Vitamin C		****	*
Vitamin D		—	*
Vitamin E		—	**
Ca	...	—	*

[3] Barnell, H. R. (1940), The banana in relation to human nutrition. *Trop. Agric.* **17,** 148–146.

[4] Datta, S. *Science and Culture,* **XI**, (8), 394.

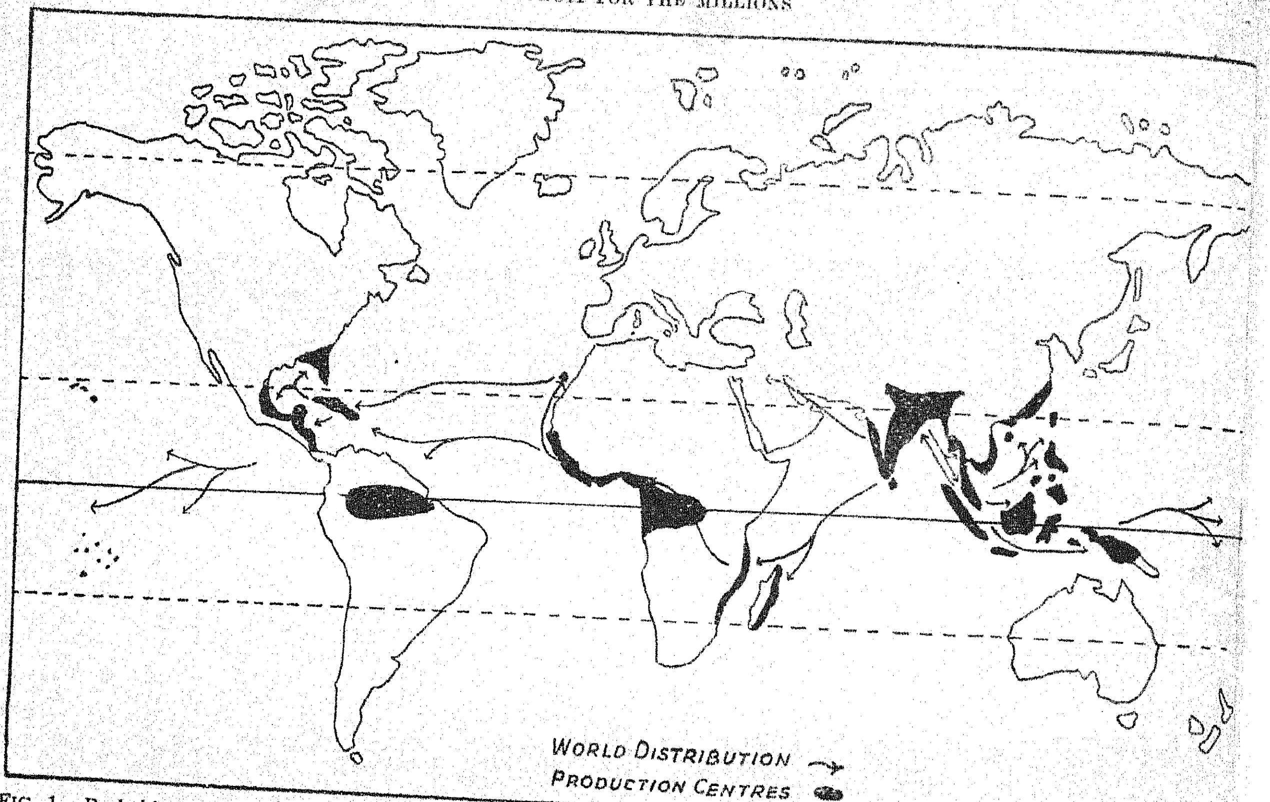

FIG. 1. Probable line of distribution of banana throughout the tropical world has been shown with arrows. The present production centres are shaded.

FIG. 2. A fruiting banana plant, with two baby suckers. The rhizome and the root system are also shown below ground level.

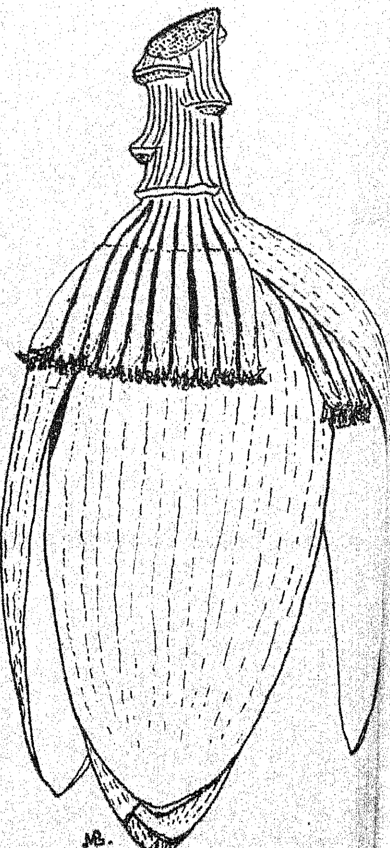

FIG. 3. An inflorescence with the bright bracts and cluster of flowers. The scars of fallen bracts as well as the flowers can also be seen.

Fe	...	*	*
PO_4	...	—	**

— Indicates either nil or not ascertained.
* Indicates the presence of a good quantity.
** Indicates the presence of very good quantity.
*** Indicates the presence of rich contents.
Acid content in banana is presumably negligible, both when green and ripe, as opposed to Mango.

Soil and climate

Subject to a liberal supply of water and sunshine, suitably close to a tank, ditch, *jhil*, canal or a river, banana can be grown in almost all soils, except where the soil is heavy and the sub-soil is hard rock or stiff clay. In one word the soil should be deep and well drained. Banana being a gross feeder, maintenance of soil fertility is of supreme importance. Where virgin soil is brought under plough the question of manuring does not crop up at once, but attention must be given to this question in the future. In poor soils the plantations should be removed every ten years and less exhaustive crops should be grown if the land is not left altogether fallow.

In India banana is cultivated from Cape Comorin to Himalayan heights and is thus subject to a wide range of climatic conditions. But it is a lover of warm, moist climate with a high degree of rainfall. This is why banana grows best in Bengal; next comes Madras and then Bombay. The extreme climates of Northern India hinders the extension of banana plantation there.

Propagation

After ripening of the bunch, the pseudostem bearing it is cut back closs to the rhizome, and from here lateral off-shoots or suckers are developed and the growth is continued by them. Thus, the life of the individual plant is indefinite. The extra suckers (there should not be more than three at the base), are removed for establishing new plantations in June or July. Sometimes sections of rhizome with one or two buds are also used for propagation.

Preparation and planting

Where virgin soil is brought under plough, the question of preparation is not a problem but in case of cultivated lands, preliminaries for the preparation of soil is of supreme importance. Firminger's[5] method is recommended: Soil operation should be begun any time before rains, let us say in January. Soil is deeply ploughed and left to the action of the elements. Then just as the rains break, sunn hemp (*Crotalaria juncea*) at the rate of 40 lb. of seed per acre is sown. This will come up vigorously with the rains. After some weeks it is cut down and ploughed *in situ*; let it rot well to harrow again. At the end of the rains, pits, 12 ft. apart, are dug for the fruit trees and between them a crop of deep-rooted legume is given to break up the sub-soil,—a short season groundnut, such as small Japanese, is admirable. The nuts are harvested and the roots, stem, etc. are retained to the sub-soil.

One year after the start of soil operation suckers are planted in pits within fields of standing *aus* paddy, arum, brinjal, ginger, if not nuts already mentioned. The suckers should preferably be 'maiden' suckers, i.e. suckers about eight months old, with adult foliage as opposed to 'sword' suckers, which are younger with narrow leaves. As has already been said, suckers are usually planted in the rainy season. The pits should be about a cubit deep and should be manured. Sometimes dried banana leaves are burned and put into the pits to check termites; fresh cowdung is also added.

Maintenance of soil fertility

However rich the soil may be, the fertility level should always be maintained *at par* as banana is a gross feeder. Baillon[6] *et al* found that the banana plant absorbed from the soil a moderate amount of nitrogen, little phosphorus and a very large amount of potash, the latter accounting for 10 per cent of total potash lost from the soil. In India similar results were, however, obtained by Norris and Ayyar[7] as early as 1925. The scheme of manuring should be aimed at maintaining the equilibrium of the replenished earth. In India farmyard manure, oilcakes and bonemeal are used as well as wood ash and bonemeal, though the latter were not frequently used by the orthodox

[5] Firminger, T.A.C. (1890). *A Manual for Gardening for Bengal and Upper India*, 175.

[6] Baillon, A. F., Holmes, E., and Lewis, A.H. (1933). Composition and nutrient uptake of the banana plant with special reference to Canaries. *Trop. Agric.* **10**, 139-44.

[7] Norris, R. V. and Ayyar, C. V. R. (1925). The Nitrogen and mineral requirement of the plantain. *Agric. J. India* **20**, 463-7.

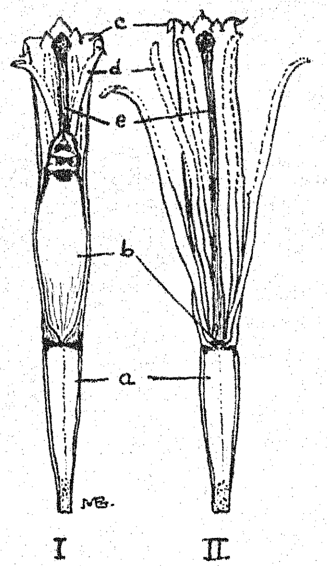

FIG. 4. Flowers of banana I & II. a, the inferior ovary ; b, the *scale ;* c, the perigonium ; d, the stamens and e, the style with the stigma. In fig. II, the scale has been removed to show the position of the style and stamens.

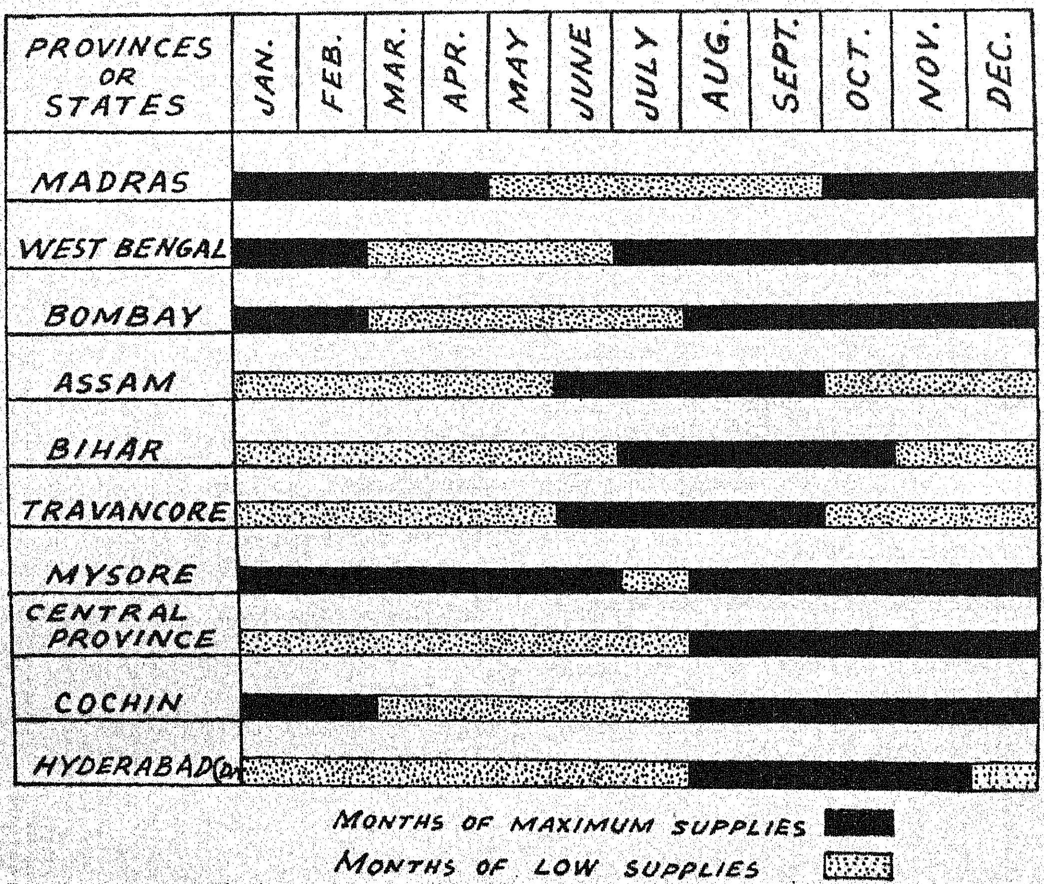

FIG. 5. Seasonal production and supply of banana in the market. (Taken with modifications from *Marketing report of Banana in India*).

cultivators earlier. Compost is now a byword If, however, this excellent manure is not available, fresh nightsoil may be used. Firminger (loc. cit.) suggested 15 lb. of F.Y.M., 5 lb. of bonemeal and 7 lb. of wood ash per plant for the first year and 5 lb. F.Y.M., 5 oz. of bonemeal and 1 lb. of wood ash per plant for the second year. Green manuring is desirable once a year and the soil must be kept well hoed.

Control of diseases and pest

Panama disease (more popularly known as banana wilt caused by the fungus *Fusarium cubense*) first attracted attention in Panama and Costa Rica early in this century, and caused serious loss and abandoning of cultivation in large areas in the West. From the survey of the banana areas of tropical America and West Indies, it has been concluded that fundamentally the disease developed as the result of unfavourable soil conditions. Flood fallowing of areas affected by wilt has given effective results as has been definitely concluded by Wardlaw[8] from observations and experiments carried out in the West. This flood fallowing, however, may not be successful in the case of acid soils.

In the East, serious loss is caused by a disease, which passes under the name of 'bunchy top' and was originally supposed to be associated with the attacks of the nematode, *Heterodora radicicola*. This supposition has been reviewed by scientists who have indicated that the disease falls into the group of virus diseases not directly transmissible. In this case the agent of transmission is the aphid, *Pentalonia nigronervose*; Ocfemia and Cartimisan[9] definitely concluded that there was no association between the disease and the nematode. This trouble has been effectively controlled by the total destruction of the diseased plants.

The black rot disease, caused by the fungus *Gleosporium musarum*, is responsible for the loss of fruits on the plant as well as in the store. Spraying with ammoniacal copper carbonate prevents it from the malady. There is scope for raising improved varieties, especially disease resistant ones, through breeding.

The question of quarantine measures which of late has been in the limelight should be seriously considered. For example, banana wilt is a serious disease and occurs in Madras; therefore, suckers imported from the province must be certified free from wilt to check the spread to other provinces; the same method should be applicable to other diseases as well. It is a remarkable fact that banana has no serious insect pest in India which can justify control measures.

Earth worm (*Pheretima indica*) creates havoc sometimes, specially where rainfall is very high. It enters the pseudo-stem from the earth and even goes up to the young inflorescence and is responsible for the black scars on the fruit.

Planning a plantation

Cultivation of banana and plantain is based on two different considerations. One is for trade and the other for home consumption. For the former big commercial plantations are required and for the latter, a part of the kitchen garden.

The first consideration of planning a plantation is the selection of site. It should be as near a city and a railway station as possible, otherwise marketing will be greatly hampered for transport difficulties. The approximate cost of cultivating one acre has been estimated[10] at Rs. 225 as detailed below:

(1) Cost of 350 plants	...	Rs. 45
(2) Cost of planting in the pit	...	Rs. 35
(3) Cost of ploughing, etc.	...	Rs. 20
(4) Cost of manure, etc.	...	Rs. 125
Total	...	Rs. 225

Apart from the cost of cultivation, cost of maintenance, supervision and fencing has also to be incurred, which are not detailed, as also the profit which may be obtained from the secondary crop cultivated in between the planting and fruiting time, as well as the prices obtained from the fibre extracted.

In the first year the return is always poorer than the succeeding crops, but in the first year inter-cropping is the common practice, (which however is not practicable where the intervening distance is less than what has been indicated earlier) and it yields some profit. In the first year more than 300 bunches may be obtained, which is doubled or trebled in the

[8] Wardlaw, C. W. (1947). *Nature*, **160** (4064), 405.

[9] Ocfemia and Cartimisan (1928). *Phytopath.* **XVIII**, 10.

[10] Guha, M. P. (1948) Banana—the fig of paradise. *Modern Review* (April), 1948, 299-203.

succeeding years, as there will be three suckers of different ages left in the stool, after cutting down the parent plant after harvest. The average market price for each bunch is near about Rs. 2.

There is a wide variation in the distance at which bananas are planted in India. As close spacing always leads to almost total exhaustion of the soil, it is better and wiser to make the intervening spaces wider which ultimately give better result in quality, size and quantity of the yield.

Marketing

Of the total production of 109,841,000 maunds estimated in 1940-41 (loc. cit. 2), the total available in the market was 87,087,000 maunds, the rest being retained by the producer for home consumption. The annual wastage has been estimated at 1,532,400 maunds and out of the rest a little more than 14 per cent is utilized for cooking, a little more than 85 per cent utilized for table purposes and less than 1 per cent for industrial purposes.

On account of the perishable nature of the fruit, banana requires special handling and the fruit must be cut at a stage of maturity adapted to the length of the journey, and in case of longer journeys, special provision for cool chambers are necessary. According to Wardlaw and McGuire[11] a storage temperature of 54°F. is generally aimed at during transportation. Sometimes the stem end of the bunch is smeared with vaseline or melted paraffin to check diseases, and to keep the fruits fresh for a longer time. The special adaptability of the Champa variety, which stands longer journeys well without special care, has led to its extended cultivation in Northern and Eastern India. The best provincial varieties are generally limited to even a district due to their soft peel, which requires special methods of crating.

Banana is the only fruit of importance which is available in the market throughout the year, although there is seasonal variation in supply as shown in Fig. 5.

Economic aspect

Fibres extracted from banana closely resembles that of *M. textilis* (popular as Manila hemp), although not so strong. Wild varieties should be explored for extraction of fibre. Sarker[12] gives a long list of articles that can be manufactured with the fibre, such as rope, twine, chord, nets, bagging, sacking, matting, carpeting, lace, plaits, braids and even handkerchief. Even the coarsest fibre can be utilized for paper-making and the rejected tow for packing and stuffing purpose. The only difficulty is the expense of transporting to the factory, which, however, can be overcome in case of large plantations, where this industry may develop as a by-product. The dried, powdered and sifted flesh of the fruit (banana or plantain meal) should preferably be manufactured from mature but unripe fruits, as the starch changes into sugar during the ripening process. Essences and *attars* may be prepared from ripe bananas though synthetic products might be cheaper. Alcohol can also be manufactured. Jams, jellies and marmalades can be manufactured with profit. *Kshar* is prepared by burning dried leaf sheaths of banana or plantain plant and this detergent, which is equal in action to washing soda, is being utilized by our village people, for washing their clothes by boiling from times immemorial.

[11] Wardlaw, C. W. and McGuire, L. P. (1931). Bananas, Publ. No. 35, Emp. Markt. Board, Lond.

[12] Sarker, J. K., (1917). *Handbook of Plantain Fibre and Fruit Industry*, 10.

A BRIEF REVIEW OF BRITISH AGRICULTURE DURING THE LAST WAR

By S. K. ROY

MOST parts of Great Britain were not considered suitable for arable crop farming. Not unnaturally, therefore, between the two great wars when imported foodgrains were very cheap, farmers unable to compete with the foreign markets, concentrated mainly on dairy and livestock farming. Most of the farmers depended on permanent pasture or long leas for rough grazing and hay for their livestock, supplemented by roots which were grown in small areas. Almost the whole of the concentrated food for their livestock was purchased from abroad.

The outbreak of war in 1939 deprived her of the produce of vast areas of land overseas; imports of grains and concentrates for cattle food were very much reduced. It became absolutely necessary to increase her production of grain, potatoes, and beet. With new knowledge and new facilities, the tractor, cheap and effective fertilizers, new and improved strains of crops and of grasses and clovers, all these demanded altered systems of farming if the land of this country had to be turned to the best national use, to the best economic advantage to the farmer. The main drawback to this extension lay in the fact that such extension reduced the area of cow-keep, just when the latter was most needed.

Potato growing

Potato growing has for a long time been a feature of farming in this country. It would seem that its extension should have presented no great difficulty, but it caused difficulties out of all proportion to the area involved. Of all farm crops it demands the greatest amount of labour, and the increase was called for in a period of acute labour shortage. It is a crop on which only men equipped for its cultivation can make money, while new-comers to the industry will lose money. The required increase could not be obtained only from the well equipped farmers—the quota had to be shared out among all farmers, experienced and inexperienced alike, who had land in anyway suitable. Wheat presented less difficulty as a crop.

S. K. ROY is a scholar in King's College, Newcastle upon Tyne.

Land reclamation

A survey was at once instituted by each County Executive Committee to discover what land in an unproductive state could be turned into account. Marshy land was drained by deep ditches and pumps were installed; pipe drainage and cultivation followed. Such land previously lying under indifferent grass, though difficult of cultivation, proved very fertile.

No doubt some of these adventures were very spectacular but taken as a whole these were too limited in scope to affect the gross output of the country very much. The total gains amounted to less than the losses to the defence services for aerodromes, camps and depots. The main contribution to the national output had necessarily to come by way of general improvement in farming technique. The Executive Committee worked therefore to find out every farm grassland suitable for ploughing.

Cultivation by contract

The implement shortage was eased by the development of the practice of cultivation by contract. A large number of small firms of agricultural contractors, equipped with tractor tools, sprang into existence, and if their initial skill left something to be desired, they learned their job quickly.

Ploughing-up and cultivation of old turf

The first impetus to a movement that had already started was the declaration of £2 (Rs. 27) subsidy per acre by the Government in 1939 for the plough-up campaign. Emergency fertility was the immediate aim, but a farmer could not create emergency fertility without doing something that would have an enduring influence on his farm, and therefore on his methods of husbandry; and this, though a secondary effect of the subsidy, was really its greatest strength. Because of this secondary influence, the £2, supported by the lime and slag rebates, constituted a generous State aid to land improvement—an aid that

every far-seeing farmer availed of, emergency or no emergency. To the farmer himself the enduring aspect of the subsidy was of more importance than its emergency aspect.

The first crops

The first crops were commonly oats or wheat. There were comparatively few failures. In the beginning, yields were high while weeds, though generally increasing, were kept in check. But as the war progressed and more old pastures were brought under the plough, it became increasingly difficult to find fields suitable for ploughing. Pipe drains silted up rapidly and many fields, though under-drained, became too wet for successful cultivation owing to the condition of the pipes. Many fields which were dry enough for cultivation when first ploughed out became sticky and difficult after the turf had rotted. Farmers had, therefore, often to risk cultivation on indifferently drained and difficult land. Taken as a whole, however, cultivation of old turf was entirely justified by results.

Regular rotation

By the end of 1943, the total area of grass, both permanent and temporary, had been reduced to below $1\frac{1}{2}$ acres per cow equivalent. The time came for seeding down again. The process of bringing the enlarged area of arable land into something like regular rotation then commenced. Much land had to be seeded down without passing through a year under cleaning crop. On the wetter soils preliminary half-fallows had to be invoked. The practice of seeding without a cover crop proved very satisfactory. By various means a balance of tillage crops and lea was gradually established. The arable land of the country could now fairly be described as under a six-course rotation, with four years of tillage crops and two of lea.

Herd management

During this period, however, there was no change in the country's cattle stocks. In fact, numbers rose slightly towards the end of the war. In 1942, the Executive Committee launched a programme of herd improvement because much cross-breeding and purchase of nondescript cattle had been practised. A drive for higher yields and a greater proportion of winter milk was instituted by survey, and verbal, written and visual appeal. The approach to improved breeding was advocated, firstly, by the use of sires of known milking ancestry and, secondly, by the insistence on continuity in breeding policy. Sires of any particular breed, however, was not insisted though the desirability of adopting one breed, and sticking to it when adopted, was stressed. Since good records of sires of dairy breeds were more easily obtainable than those of dual purpose type, Ayrshires and Friesians increased rapidly. The demand for bulls from milk recorded stock increased. The propaganda had immediate effect.

In the analysis of costs and benefits, the technique for measuring improvements is inadequate for calculating the cost of agricultural improvement works for three major reasons. It seldom takes into consideration : first, multiple uses and benefits ; second, intangible uses and benefits that cannot be measured in terms of money and sold ; and third, costs or losses that are being experienced and will continue to be experienced if the contemplated measures of improvements are not pursued.

The net results of agricultural improvements in Great Britain, during the last war may, however, be summed up as follows : Six million acres of old turf were ploughed and cropped, the arable area was increased by more than one-third, and the tillage area increased by half. The production of cereals was increased by sixty-six per cent, potatoes by eighty per cent, and vegetables by eighty-eight per cent.

WIND EROSION AND ITS CURE

By S. ATTAR SINGH

THE removal of soil is called erosion. It is caused by wind and water. The latter of course, is the most damaging factor in the Punjab.

What is wind erosion

It is sand blown by dry, hot, strong and fast winds and deposited on cultivable fertile land, which reduces its fertility and thereby renders it unfit for further cultivation.

The removal of soil particles by wind is a less noticeable phenomenon than gullying by water erosion but it is nevertheless of considerable importance in some of the lands of the Punjab. Wind blown sand tends to form a special landscape of long flat stretches broken by hummocks with bush growth on top of them and wind channels hollowed out all round the miniature hills. Where level plains of grassland have been too heavily grazed the grass tends to disappear and be replaced by deep rooted bushes round which the wind generally builds up sand dunes. Such dunes menace neighbouring fields and pastures because any storm may drive the sand on to them and cover them.

Duststorms are proverbial in the southern part of the province and are a scourge to the local inhabitants. A vast stretch of the country has been buried in sand, and on its outskirts the drifting sands gradually encroach on the neighbouring land and render it unculturable in time. The dry hot winds blowing from this tract prove detrimental to field crops on account of their desiccating effect.

There is no doubt that severe wind erosion is going on and that in some regions it is definitely on the increase. Survey records of 1870 and 1935 show desert increase brought out by conditions on the ground. Not only is there a general movement of sand from south-west to north east across the plains in all the southern districts of the East Punjab, except where irrigation is established, but there is a much local increase of sand drifts and dunes extending eastward out of the main shallow drainage channels throughout the districts of Ambala, Jullundur, Karnal and the States of Patiala and Faridkot. It is only after a fairly accurate location of such conditions that we can attempt to plan in detail our desert-fringe conservation measures. Figures on sand-storm damage are not available and probably never will be. It is a case of judgment and vision rather than statistics.

S. ATTAR SINGH is Forest Publicity Range Officer in the East Punjab.

The contributory factors

Bare fields, dry soil, and high wind, and an unobstructed sweep for the wind are the four factors which contribute to the severity of a sand-storm.

Everyone must be familiar with the tragic tale of the America's 'Dust Bowl' where ill-considered ploughing of natural grasslands and failure to provide shelter-belts in a hot wind-swept country, somewhat similar to the Southern Punjab, led to wind erosion. The plough destroyed the grass sod, which, with its mat of roots, had bound the light powdry soil for centuries; the soil thus exposed became the plaything of the winds and millions of acres of land went out of cultivation. The resulting poverty and suffering have been ameliorated to some extent by the Federal Government's action in planting a vast number of narrow shelter-belts along field borders, roads, railways and waste lands to form a defence against the prevailing wind. Unless some similar project is worked out for our desert-fringe districts of Gurgaon, Hissar, Sirsa, Ferozepur, Fazilka increasing poverty and aridity in this already treeless tract will be unavoidable.

Control of wind erosion

The same principle holds for wind erosion as for water erosion. Sand dunes form only when the natural plant cover has been thinned out or destroyed through misuse and the obvious way to prevent sand blowing is to keep plenty of shelter-belts and wind breaks of tall grasses, bushes and tree-growths, to prevent cattle from destroying the natural grass-lands and to keep a good proportion of field

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Control of wind erosion

The same principle holds for wind erosion as for water erosion. Sand dunes form only when the natural plant cover has been thinned out or destroyed through misuse and the obvious way to prevent sand blowing is to keep plenty of shelter-belts and wind breaks of tall grasses, bushes and tree-growths, to prevent cattle from destroying the natural grasslands and to keep a good proportion of field

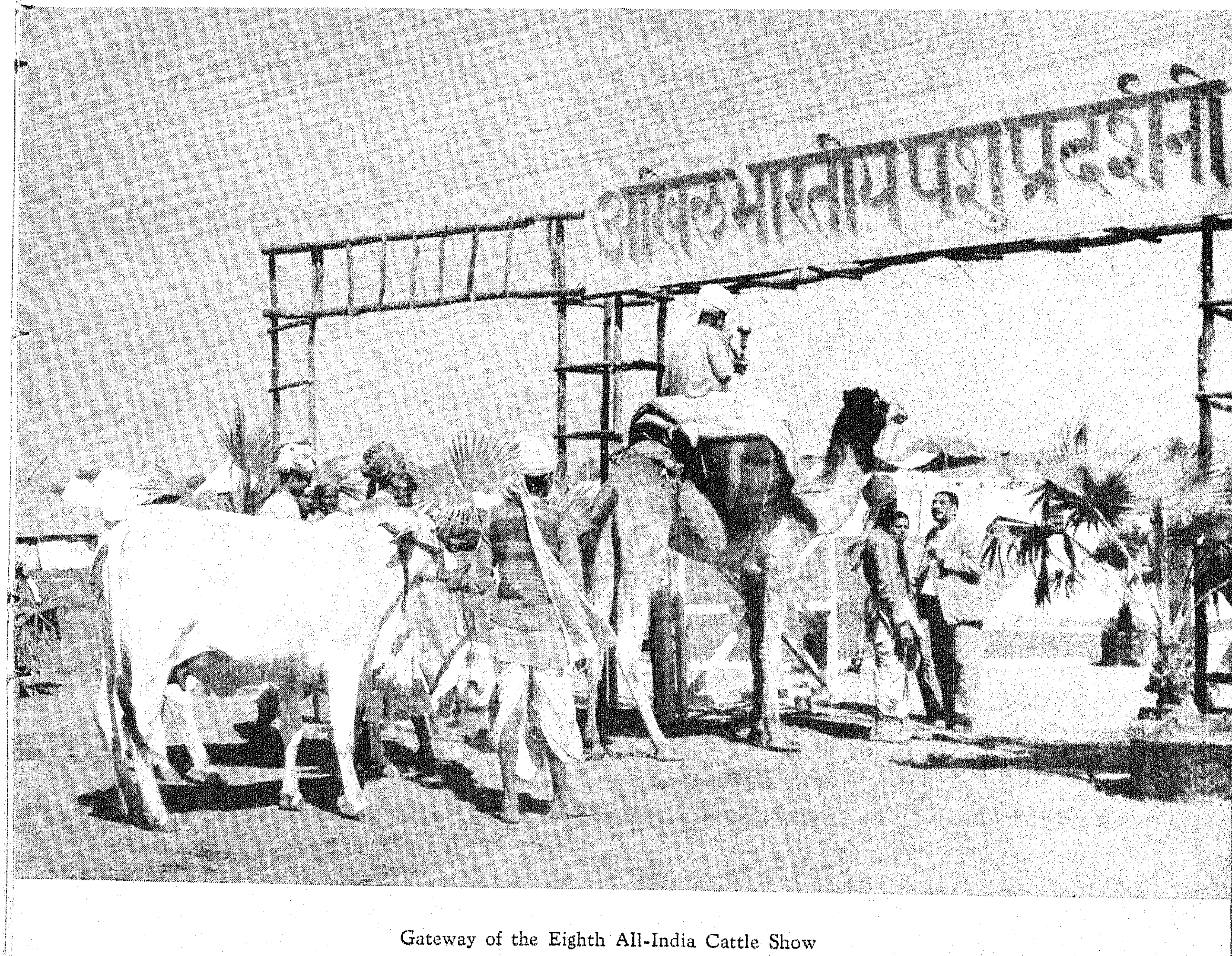
crops in dense strips at right angles to the prevailing wind. This type of work is very badly needed throughout Rohtak, Hissar and Sirsa areas.

To stop the strong winds and to act as obstacles and barriers in their passage, trees are usually planted in one or two or three rows; such rows of trees are called wind belts. These belts should make right angles with the direction of winds and the distance from one belt to another should be half a furlong to one furlong. Each belt will be effective on an area ten times in length of the average height of the trees. The tall trees should be planted in the middle row and on both of its sides only hedges or bushes should be planted. But the ideal form of shelter-belts to break the force of desiccating summer west wind is probably to grow agaves on the outer and lower fringe then cane grass and shrubs leading up to high trees in the rear.

Afforestation need not necessarily be with timber trees and much of the desert fringe in its present conditions simply will not allow them to grow. We can, however, do a great deal with giant cane grasses (*Saccharum munj* and *S. spontaneum*) which have previously been treated as weeds in the Punjab. The series of wind breaks, as already pointed out, must be established at right angles to the wind. Another important point is that *watts* should be constructed around wind-belts so that rain water could collect and get absorbed then and there, as because of rain shortage the trees in the Southern Punjab do not grow to their full height.

These shelter-belts have been successfully used in foreign countries to check wind erosion. The landes of France and the sand dunes of Palestine are conspicuous examples of what can be achieved in the way of land reclamation and control of sand drifts by planting trees.

Therefore, one of the most important activities of the East Punjab Forest Department is to establish these wind breaks and shelter-belts in appropriate areas. Individual farmers are discouraged by such a long term programme or may be deterred by lack of funds, or may not have inclination or the necessary foresight, knowledge and experience to take interest in such activities. The greatest possible inducement should, therefore, be offered to individual farmers to undertake the job.



Gateway of the Eighth All-India Cattle Show

The Hon'ble Minister for Food and Agriculture (centre) at the Eighth All-India Cattle Show along with members of the Committee; on his right is Sardar Datar Singh, Vice-President of the Committee and on the left are Mr. P. N. Nanda, Animal Husbandry Commissioner with the Government of India and Mr. M. R. Sharma, Secretary of the Committee.

EIGHTH ALL-INDIA CATTLE SHOW

By M. R. SHARMA

THE All-India Cattle Show, an event of great importance in India's capital was held at Raj Ghat which is now well known throughout the world as a place of pilgrimage. Held in the open space adjoining Raj Ghat where the cherished memory of the father of the nation is enshrined, the show could not have a better location for the realization of its objects of fostering the development of Indian cattle. It was a coincidence that the All-India Cattle Show and the Gandhi Mandap Exhibition were in progress simultaneously at Raj Ghat and were centres of great attraction. There was a record rush of visitors to the Show at all hours of the day. The increasing number of visitors both from rural and urban areas is an evidence of the growing public interest in the development of the cattle wealth of the country.

The All-India Cattle Show, held from 27 February to 4 March, 1949 was opened by the Hon'ble Shri Jairamdas Daulatram, Minister for Food and Agriculture and President of the All-India Cattle Show Committee. The Fifth All-India Poultry Show was also held in conjunction with the All-India Cattle Show from 2 to 4 March, 1949.

Importance of cattle shows

Sardar Datar Singh, Vice-President, All-India Cattle Show Committee, welcoming the Hon'ble Minister emphasized the importance of cattle shows in developing the livestock of the country. He hoped that with the continued interest and cooperation of the Provinces and States and with an increased grant from the Centre, the Committee would overcome the obstacles which stood in the way of fulfilment of its objects. Some of the best breeds in the country, he said, had gone to Pakistan as a result of the division of the country. The need for developing our own breeds was, therefore, greater and could be done by fostering a spirit of competition amongst our breeders and giving them every encouragement possible.

M. R. SHARMA is Secretary to the All-India Cattle Show Committee.

The Hon'ble Minister for Food and Agriculture inaugurating the Eighth All-India Cattle Show, which was attended among others by diplomatic representatives including the Ambassadors of the U.S.S.R. and China, Members of the Constituent Assembly and officials of the Central and Provincial Governments, complimented the All-India Cattle Show Committee on its efforts during the last ten years to improve livestock in India. He said that the gap between the effort and the ultimate aim was still large. He suggested that an extensive organization was necessary so as to reach the homes of millions of farmers who were directly interested. Efficient bullock power was essential for India's effort to increase food and agricultural production. He asked villagers and farmers to co-operate in this great national effort and emphasized the need of improving the breeds of cattle in India, if the country's economy was to be organized on sounder lines. He suggested that efforts should be made to organize from next year a cattle competition for every group of 20 villages in the country, and fixed January 30 as a national day when every village in India could participate in these competitions.

Entries received

Entries were received for 531 animals reresenting 21 important breeds of cattle, buffaloes, sheep and goats; Dangi from Bombay Province, Deoni from Hyderabad-Deccan, Gir from Junagadh and Ajmer, Hariana from the East Punjab, the U.P., Orissa and Delhi; Hissar from the East Punjab, Delhi and the U.P., Khillari from Bombay Province, Malvi from Madhya Bharat; Nagori from Jodhpur; Nimari from Bombay, Rath from Delhi Pinjrapole, Red Sindhi from Jubbulpore, Bangalore and Allahabad, Sahiwal from New Delhi, Patiala and Meerut, Tharparkar from Karnal, and Jubbulpore, Ponwar from the U.P., Mewati from the U.P., Murrah buffaloes and Nili/Ravi from the East Punjab, Jamnapari and Barbari goats from the U.P., Betal goats and Bikaneri sheep from the East Punjab.

Ongole and Kangayam, the famous breeds of Madras, and Kankrej from Bombay were conspicuous by their absence, the former due to transport difficulties and the latter owing to famine conditions in Gujarat. The total number of poultry birds exhibited was about 300. Though the organization is still called the All-India Cattle Show, it includes sheep, goats and poultry which are also of great importance in the economy of India. The exhibits generally were of a higher standard and the competition in most of the classes was keen. The show provided a common platform for breeders and officials engaged in the development of cattle to meet, discuss and exchange ideas on the subject of breeding livestock of this vast sub-continent.

Prize distribution

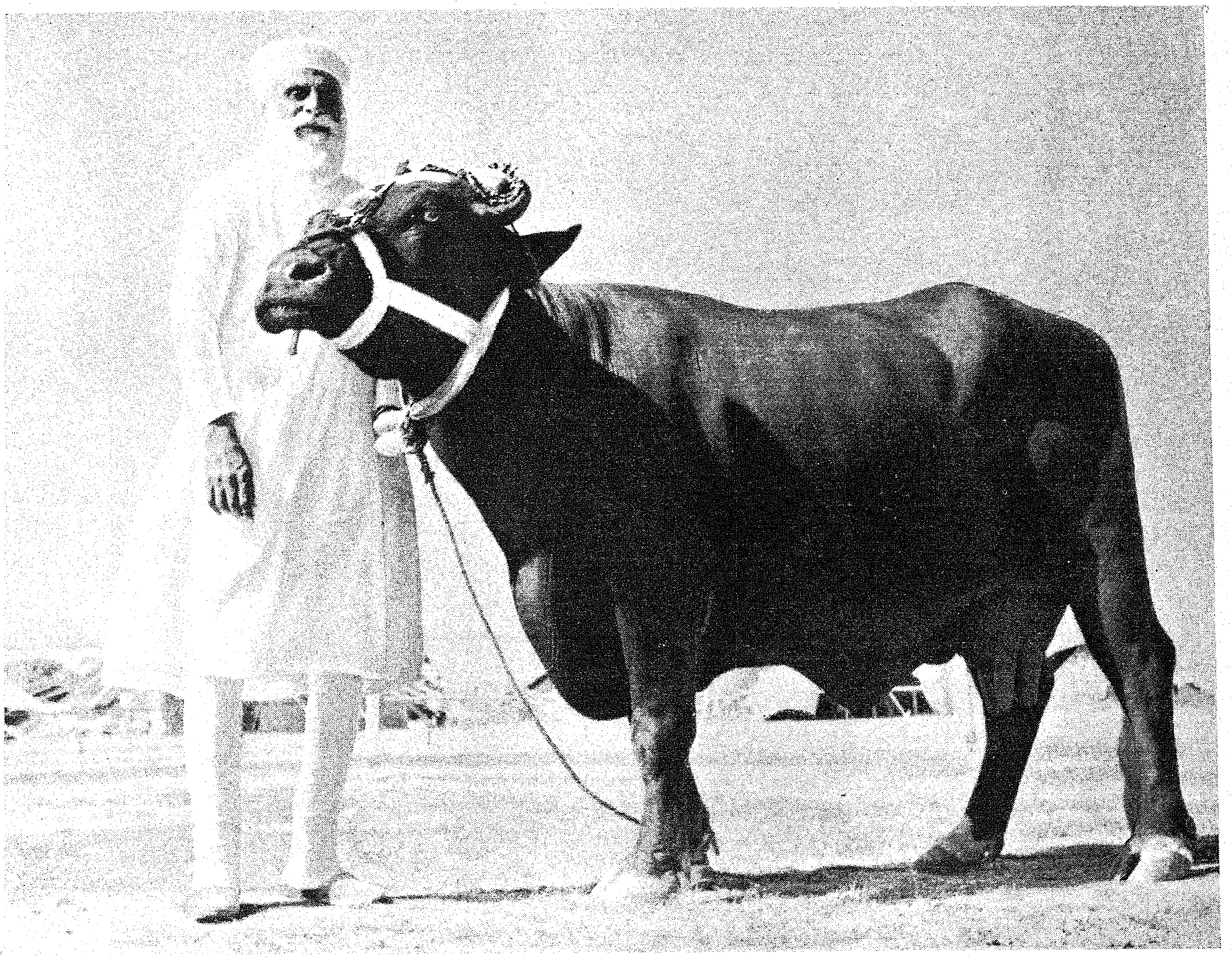
The Prize Distribution was held on 4 March, 1949 by the Hon'ble Shri Jairamdas Daulatram. His Excellency the Governor-General, Shri C. Rajagopalachari, who was to distribute prizes could not attend owing to indisposition, and sent a personal message to Sardar Datar Singh, Vice-President, in which he said: 'I am very sorry to be guilty of ill-health and of a breach of promise in consequence. I send this apology for my absence at the eighth annual show of the organization that has been rendering very useful service in animal husbandry. It is well to remember that the doctrine of non-killing and compassion will not alone improve our cattle. Well-planned and deliberate steps must be taken if we desire to possess good draught bulls and milk-yielding cows, and not animals that are a charge on our pasture and fodder crops, without being either happy themselves or contributing to human happiness. Even in the times of Valmiki, men knew the difference between good breeds and bad breeds of horses and other animals. A people, who saw good in the caste system, could not fail to see the advantage of careful animal husbandry. We have a great deal to learn from other countries as to how to plan and progress in our animal production'.

Sardar Datar Singh welcoming the Minister for Food and Agriculture said that public enthusiasm for the Show had been increasing. As compared to the number of entries received at the last Show, the entires this year were encouraging and the number of exhibition stalls was almost twice last year's number. It was revealed that the All-India Cattle Show Committee have decided that in future the All-India Cattle Show will be held at different places in the country so that people from all parts could participate in increasing number. A large and distinguished gathering which included members of the diplomatic corps, members of the Parliament, press correspondents and officials and non-officials, witnessed the prize distribution by the Hon'ble Minister for Food and Agriculture. In keeping with the practice in the past the first prize-winning animals were marched passed as the Prizes were awarded and a running commentary was given simultaneously on the loud-speakers giving details of the prize-winning animals, their habitat, distribution, merits, etc. This provided the audience with an opportunity of seeing improvements which have been affected by the stimulus the All-India Cattle Shows have given in the direction of breeding better types of cattle. It is not possible to see such a representative collection of cream of India's cattle together at any one place except at the All-India Cattle Show. Cash prizes for the Cattle Section amounted to Rs. 6,580 and in addition about 55 trophies valued approximately at Rs. 55,000 were awarded. The most coveted prize for the best animal in the Show was won by a Nili/Ravi buffalo cow belonging to H.H. Pratap Singh Ji Maharaj which was adjudged as the best animal of this year's Show and won a number of cups and cash prizes.

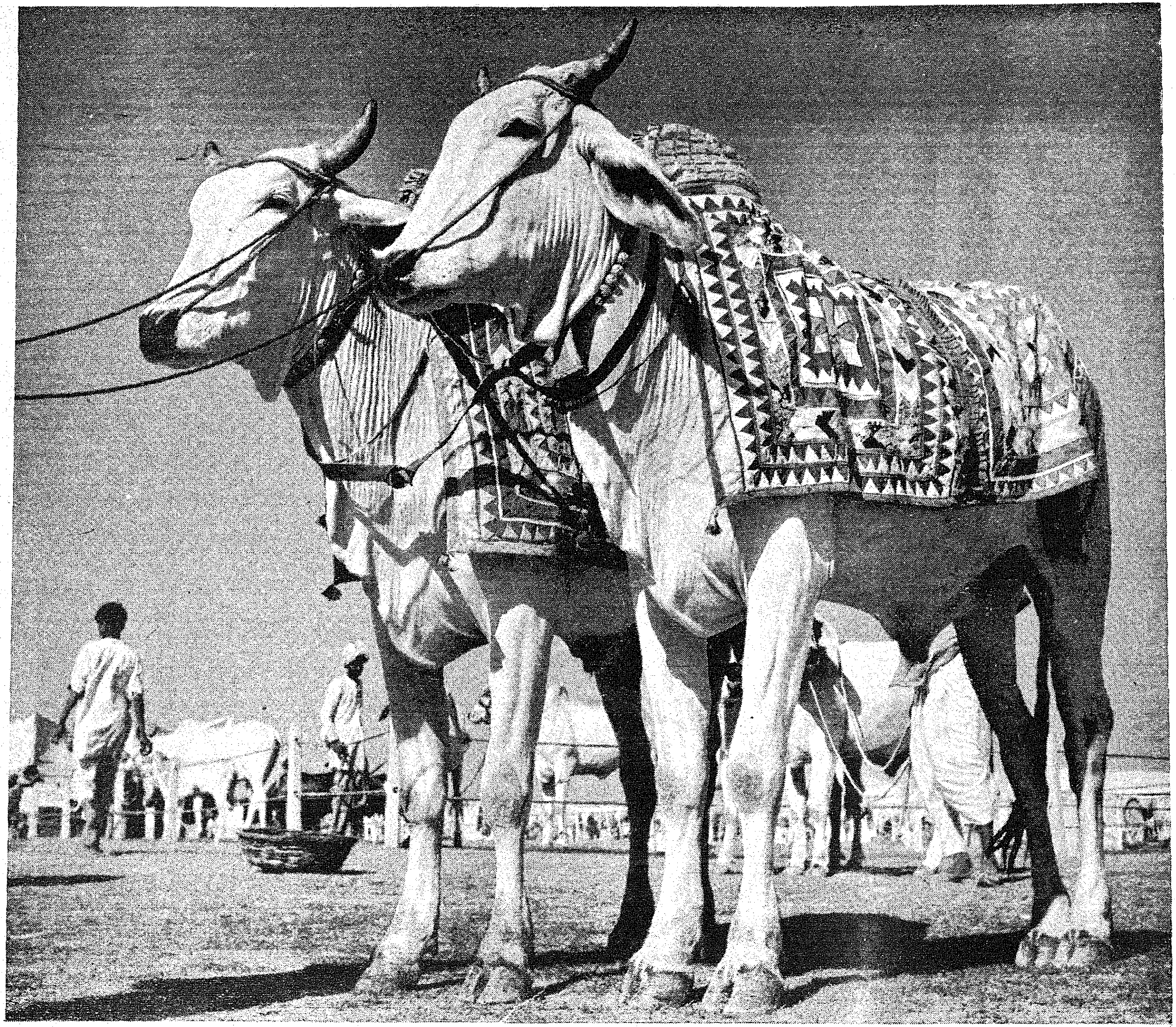
In the Poultry Section prizes amounting to Rs. 730 were awarded in addition to 20 Challenge Cups. Sardar Jagat Singh of the Kingsway Poultry Farm, Delhi, won H.E. the Governor-General's Silver Plaque for the best bird in the Show with his Rhode Island Cockerel which also won many other prizes.

Milk-yield competition

One of the other important events of the Show was the milk-yield competition which elicited keen interest and was designed to stimulate milk production. Whereas the highest milk-yield record at the Show was 38 lb. in 1947 and 30 lb. 12 oz. in 1948, this year it was 41 lb. 2 oz. in 24 hours. A Sahiwal cow belonging to the Indian Agricultural Research Institute, New Delhi, annexed the first prize for the highest milk-yielding animal in the Show. The Indian Dairy Research



'Lajjo', a buffalo of Nili/Ravi breed owned by His Holiness Shri Satguru Pratap Singhji Maharaj of Gurdwara Bhaini Sahib, Ludhiana, was declared the best animal in the All-India Cattle Show. She was also declared the best buffalo cow in the Show.—P.I.B.



A pair of bulls of Nagori breed from Jodhpur ready for the auction sale of cattle which was held along with All-India Cattle Show.—P.I.B.

Institute, Bangalore, got the award for the highest milk-yielding Red Sindhi cow.

A Students' Judging Contest is organized every year to train students in the art of judging cattle. It was held on the opening day of the Show. Seven teams from the various colleges and institutions in India entered the competition which was the object of enthusiasm and keen interest not only for those who formed the teams but also for those who had come as spectators. The team entered by the Indian Veterinary Research Institute, Izatnagar, stood first and won Rs. 75 and a shield presented by Messrs. Polson Ltd., Bombay, for this contest. The second prize of Rs. 60 was won by the team of the Indian Dairy Research Institute, Bangalore.

Sale of cattle

The auction sale of cattle attracted a large number of entries. The auction was conducted in one of the judging rings on 3 March 1949 and Mr. P. N. Nanda, Animal Husbandry Commissioner with the Government of India and Chairman, Executive Committee, All-India Cattle Show Committee, presided. The highest price, viz. Rs. 750 was fetched by a Hariana young bull owned by Ch. Pratap of Rohtak. There was a great demand for Hariana cattle. Other animals sold at the auction sale also fetched good prices, which are otherwise not possible for the breeders to obtain for their animals.

Breeders' conference

The other notable feature of the Show was the Second All-India Cattle Breeders' Conference which was convened on this occasion. Breeders from all over the country met in a three-day session. The Vice-President, All-India Cattle Show Committee in his presidential address stressed the need for developing such breeds as Red Sindhi, Tharparkar and Sahiwal as these have gone over to Pakistan. The conference passed a number of resolutions urging the Government of India to arrange for the multiplication of the breeds lost to India due to partition, development of dual purpose breeds, restriction of the sale and export of animals from their home tracts and to formulate a definite policy for the improvement of cattle in all the provinces and States. The conference also recommended the 'Key Village' Scheme to be adopted for the development of livestock and suggested that lands should be given to breeders for cattle-breeding on certain conditions.

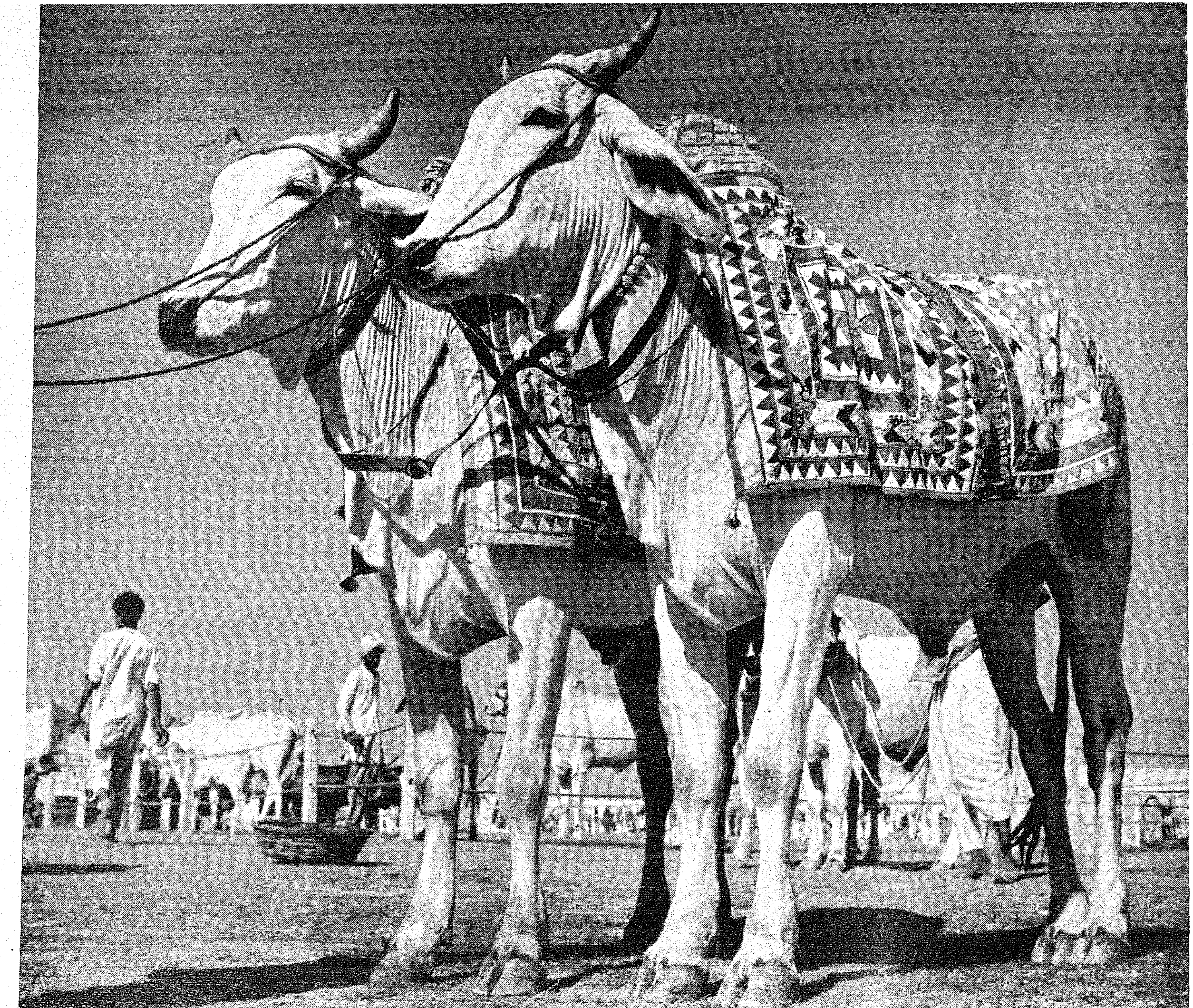
The conference, which was attended by delegates from Bombay, the U.P., the East Punjab, Madras, Mysore, Coorg, Hyderabad, the C.P. and Berar, Rajputana, Madhya Bharat, Kashmir and Travancore, also decided to organize cattle shows all over India with the ultimate aim of arranging one show for every 20 villages every year. It was further decided to approach the Government of India for special funds for the All-India Cattle Show Committee.

Exhibition stalls

A remarkable feature was the large number of exhibition stalls at the Show which attracted large crowds. The stalls were well decorated and imparted useful knowledge in the sphere of agriculture in general and Animal Husbandry in particular. A noteworthy feature of this year's Show was that most of the charts and illustrations had explanatory notes in Hindi. The villagers, who in the past were deprived of information contained in these charts and illustrations, as English was used therein, paid special attention to these and took full advantage of this opportunity to learn the results of research in scientific and systematic cattle-breeding.

The All-India Cattle Show which is becoming more and more popular drew large crowds at all hours of the day both from urban and rural areas. Vast propaganda was carried out through posters, hand-bills and broadcasts, particularly by the inclusion of items on cattle show in the rural programmes. The proceedings of the Show were filmed and the All-India Radio arranged for the broadcast of the special features and results of judging on a number of occasions. The All-India Cattle Show Committee also published a revised edition of the pamphlet entitled *The Role of Livestock in the Economy of India* for which there was a great demand.

A cinema show on cattle shows and development of agriculture in foreign countries, with special reference to their application in this country, was also arranged at the instance of the Hon'ble Minister for Food and Agriculture.



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A cinema show on cattle shows and development of agriculture in foreign countries, with special reference to their application in this country, was also arranged at the instance of the Hon'ble Minister for Food and Agriculture.

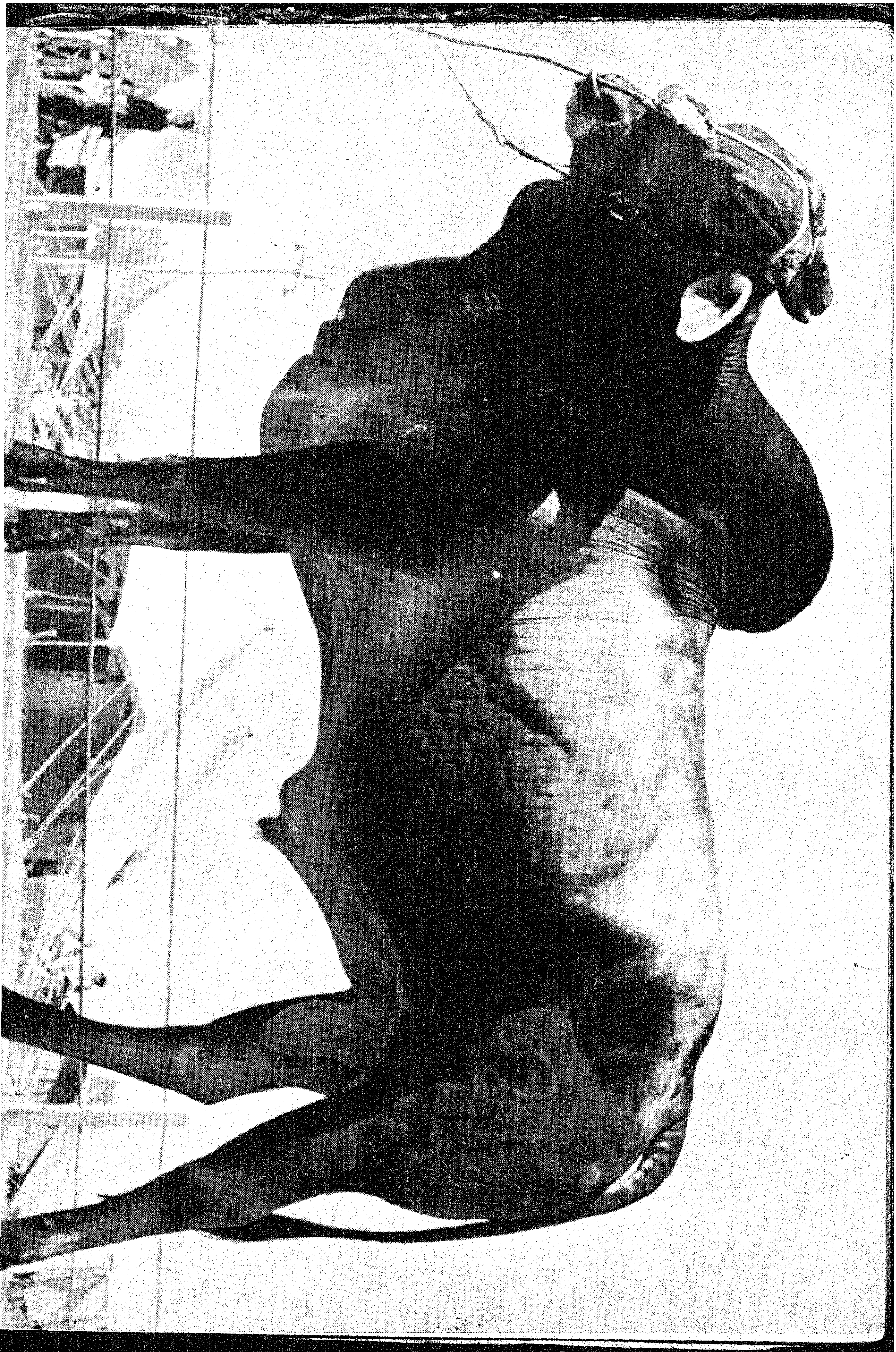
About 400 villagers from the adjoining villages took advantage of this opportunity of seeing the film a running commentary on which was given in Hindi.

The prize distribution was witnessed by over ten thousands people. Photographs of the important events and of prize-winners at the Show were taken. The expanded activities of the All-India Cattle Show Committee and the special features noted earlier designed to stimulate the breeding and development of Indian cattle added considerably to the importance of this Show. Finally it may be said that the All-India Cattle Show was a great success.

CONTROLLING FLIES WITH B.H.C.

LABORATORY and field studies have shown that the primary cause for failures of DDT residual sprays to accomplish satisfactory fly control in Southern California areas during 1948 has been the development of fly resistance to DDT and related materials. This resistance to DDT has developed to such a magnitude in some of the fly strains collected in the field, that it is virtually impossible to obtain 100 per cent knockdown and kill of the flies by means of residual DDT spray treatments.

Field studies have shown that benzene hexachloride appears to be the most satisfactory material of those tested for the replacement of DDT in residual sprays in dairies and comparable outdoor situations. This material used at 17 pounds of a 12 per cent gamma isomer wettable powder in 100 gallons of spray (approximately 0·25 per cent gamma isomer) accomplished effective control for three weeks to one month during the hottest summer weather and up to two months during the cooler fall weather.—*Imperial Chemical Industries, Technical Service Department Report* No. GCS/PC/116.



This bull of Hissar breed belonging to the Government Livestock Farm, Hissar, was declared the best bull in the All-India Cattle Show. Its age is four years and eight months.—P.I.B.

LATE BLIGHT OF POT

By R. S. VASUDEVA and R. N. AZAD

IT is well known that late blight of potato caused by *Phytophthora infestans* (Mont) de Bary is common in the hills and occurs rarely in the plains of India. The disease is characterized by the presence of small, irregular, brown lesions, mostly towards the margins and tips, on the upper surface of the leaves. In favourable weather the lesions rapidly increase in size, turn black and wet rot sets in resulting in a pronounced smell of decaying organic matter. In severe cases stems and tubers are also affected. The causal organism is extremely sensitive and cannot withstand high summer temperatures that prevail in the plains. The disease was first observed in the plains of Bengal, Assam and Bihar in 1889-1900, 1912-13 and 1913 respectively. In the plains of the U.P. it was observed for the first time in 1943 at Meerut and Dehra Dun in potato crop of the variety Gola, seeds of which had been obtained from the hills.

Late blight in the plains of the U.P. has again been observed in 1948 in Gola and Phulwa varieties. Natural infection in Phulwa variety in the plains has been observed for the first time. During the course of survey of potato crop in the plains of the U.P. and Bihar in February-March, 1948, late blight was observed at Hapur (U.P.) in a few fields of

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ATOES IN THE PLAINS

potato crop raised from Phulwa seeds obtained from Patna and also in the crop raised from seeds stored in Meerut Cold Store. The infected plants exhibited typical symptoms of the disease. An average incidence of 15·5 per cent in Phulwa potato crop raised from the Patna seed material and 28·25 per cent in the crop from the local seed was recorded at Hapur in the last week of February, 1948. The second Gola crop, the seed of which is imported from the hills every year at the time of planting during December, was also found to be infected with late blight and an average incidence of 50 per cent was recorded in the end of February, 1948. By the end of March, this crop had been devastated by the disease.

Late blight of potato has so far been recorded in the plains only in the crop raised from the seed which is imported from the hills at the planting time and is not exposed to high summer temperature in the plains. The appearance of late blight in the Phulwa potato crop, the seed of which has continuously remained in the plains, is a case of secondary infection from the infected second Gola crop planted in December-January. In this connection it is to be noted that there was a very severe attack of late blight in the hills during 1947 and the seed imported from the hills obviously carried the infection. Moreover, the weather conditions during January-February, 1948, in Meerut and Hapur areas have been favourable for the development and spread of the disease.

What the Scientists are doing

ADVANTAGES OF WASHING WOOL BEFORE SHEARING AND GRADING

MOST of the wool in the Indian markets is sold unwashed because of the reluctance of the shepherds to wash the sheep before shearing, as in many cases he cannot get extra return for his labour. In fact, in many places some sand or dust is mixed with wool to increase its weight, on account of its being sold on weight basis. There is no proper grading of wool and the wool from the different parts of the body is mixed and sold as such. To demonstrate the advantages of washing before shearing and grading of wool, the Indian Council of Agricultural Research has worked a scheme in Ajmer, an area where wool forms an important commercial commodity.

This scheme has been recently completed and has given very encouraging results. The main object of the scheme was to demonstrate to the shepherds as to how by washing and proper grading of wool he could get extra money for his wool. It was no easy task to persuade the shepherd to adopt new methods and give up the primitive methods and implements. To achieve this, a number of supervisors were appointed and were given necessary training. Well in advance of the shearing season, the names of stock-owners were registered together with the number of sheep. The cooperation of the village *lumberdars*, *patwaris* and staff of the Cooperative Department was also sought in the matter. Necessary arrangements for demonstrating the process of washing, shearing, grading, storing, and transporting the produce were made. The system of payment of an advance premium at 6 pies per sheep was introduced to attract the villagers to offer their sheep for the experiment. The sheep were washed 3 to 4 days before shearing so that all the wool produced was clean. The wool was graded into white wool and coloured wool. The graded wool from all the areas was transported to Beawar, the second biggest wool market in India, and the representatives of the flock-owners were taken there to watch the open auction. The sale proceeds were distributed to flock-owners. It was found that the graded and properly washed wool fetched Rs. 20 to Rs. 30 more than the usual price per bale. The profit per sheep in this manner came to about 1 anna 9 pies per sheep, which, though a small amount, helped the shepherd considerably to adopt the improved method of grading and washing of wool before shearing. This experiment has, thus, conclusively proved that it is decidedly more profitable for the flock-owners to undertake washing and grading and that there is ample scope for improvement in the quality of wool. There is no doubt that in the beginning this can be done well only with the help of the Government. (I.C.A.R.)

You ask We answer

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and States. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. Can you let me know a cottage scale method of dehydrating potatoes and oblige.

A. 1. *Raw material:* Potatoes of large size, free from disease and fully ripe, with the least possible number of eyes, are selected.

2. *Washing:* They are thoroughly washed in running water to remove dirt and other sticking matter.

3. *Peeling and trimming:* These operations are done by hand. Peeling of washed tubers may either be done by means of sharp stainless steel knife or by means of *sippis*. Peeling with *sippis* gives better results but is rather costly. Eyes and any other damaged portion should be removed carefully, care being taken that after peeling and trimming the potatoes are kept immersed in water.

4. *Slicing:* Peeled potatoes are sliced about 3/6 in. thick in ordinary fodder cutter type slicer with adjustment to cut slices of desired thickness. These slices of potatoes are immediately put in stainless steel tanks containing cold water. But when the slices have to wait 5 to 6 hours before putting into the dehydrator they are placed in 0·05 per cent potassium meta-bisulphite solution to avoid blackening and spoilage.

5. *Blanching:* The prepared slices are then put in small lots of about 15 lb. in a perforated galvanized iron bucket, which is placed in boiling water in an open galvanized iron tank heated on direct fire. The bucket is constantly stirred and the temperature of the water is not allowed to go below 190°F. till the slices are properly blanched. The bucket containing the blanched potato slices is then dipped in cold running water.

6. *Dehydration:* The prepared slices are put in single layer on wire gauze (1/8 in. mesh) trays, 1 sq. ft. containing about 1 to $1\frac{1}{4}$ lb. of slices. The trays are then put in the home drier (description given below) or loaded on a trolly which is pushed in the tunnel type dehydrator at its cold end. The door of the dehydrator (temperature at cold end 140 to 145° F. and at the hot end 170 to 180° F.) is then closed air tight. After $2\frac{1}{2}$ hours a second loaded trolly is rolled in and the tunnel again closed air tight. The process is repeated for the third trolly also. After $2\frac{1}{2}$ hours after the third trolly has gone in, the first trolly is ready to be taken out at the hot end with dried potato slices and another trolly freshly loaded is put in through the cold end. In this way the process becomes a continuous one. Thus after every $2\frac{1}{2}$ hours one trolly with dried slices is taken out and freshly loaded trolly is put in at the cold end.

During the process air is forced in with a fan put at the top of cold end and temperature and humidity are controlled with the help of side dampers.

Temperature at the cold end:	140 to 145°F.
Temperature at the hot end:	160 to 165°F.
Humidity at the cold end:	40 to 45 per cent
Humidity at the hot end:	20 to 25 per cent

The home drier consists of a strong galvanized iron sheet box 3ft. × 2ft. × 3ft. with a strong perforated iron sheet bottom. The sides and top of this box are enclosed in a wooden frame work and the box is supported on an iron stand $1\frac{1}{2}$ ft. high. Heat is applied by placing *angethi* below the perforated bottom. The drier has slits 2 ft. × 1·5 in. along the length on both sides about 4 in. below the top to let off moisture. The slits have adjustable flaps which can be opened and closed to regulate the flow of overporating moisture. This drier can accommodate seven trays, $2\frac{3}{4}$ft. × 2ft. in size.

ASSAM

H. NAG-CHAUDHURI

THE milk consumption *per capita* in India is very low in comparison to that of the other countries in the world. Within India, it is the lowest in Assam since the average milk yield per cow in this province is less than that in any other part of India. The soil condition of the plain districts of Assam is such that any lapse in hygienic and sanitary measures exposes the livestock to various infections, which, though curable by treatment, are enough to reduce the vitality of the affected animals. And with our rural people, ignorant and circumstanced as they are, such lapses are very common. The milk consumption in Assam, therefore, is still on the downward grade in spite of very many enterprises made by the people from time to time.

But Shillong, the capital of Assam, simulates the natural condition of some of the homelands of the best dairy cows of foreign countries. It thus affords a rare opportunity to develop its dairy with cows which are suited to such climatic conditions.

Dairy development in Shillong

After a preliminary study, Shillong was found to possess the requirements for proper upkeep of foreign cows. The pioneer efforts in this respect were made by some Englishmen, who brought a few English cows and proved that these cows could thrive here fairly well. The Livestock Department of the Assam Government then brought in Ayrshire and British Fresian cows and a bull in their Cattle Farm at Upper Shillong. This move not only effected an immediate increase in the milk yield in the farm and thereby made it possible to supply milk to increased number of customers, but it also gave a very good opportunity to the public of Shillong to improve their live-stock. The public availed of this opportunity. People are allowed to purchase the surplus stock of cows and heifers of the farm and to have their cows served at the farm by the farm bulls at a nominal fee. One now finds in Shillong cows of Fresian and Ayrshire character everywhere.

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The high milk yield per cow of these breeds induced a large number of people to develop small dairy herds as a commercial proposition and there are over a hundred such herds in Shillong now, all of which are supplying milk to the consumers of the town. Several of them are keeping breeding bulls of their own for their herds. These bulls are also available to the public on a small fee. The capable section of the residential public of the town are not lagging behind and many of them are keeping one or two cows to meet their domestic demand for milk, cream and butter.

Almost all the towns and cities of India are dependent on their milk supply from outside, but Shillong can be said to be self-sufficient for all practical purposes in its milk requirements, subject of course to the limitations of the purchasing capacity of the public. Besides here, as in rest of India, a high percentage of milk is used up in preparation of confectionery and sweetmeats. The local supply of milk meets this demand also. One finds more of local butter in the market than of imported tinned butter. Fresh butter in packets of different sizes, from 1 oz. to 1 lb., certainly are more convenient to the people than the tinned butter of a particular size.

This achievement, in making Shillong self-sufficient in its supply of milk and milk-products, is the result of practical demonstration at the Government Cattle Farm on one hand and facilities offered to the people to improve their economic condition through dairy industry on the other. But after all it is a localized achievement and the other parts of the province remain much the same as they

were. Proper publicity and adequate facility to the public are the crying needs now.

Publicity of veterinary achievements

In Assam, proper publicity of veterinary work and its contribution to the economic prosperity of the people are seriously lacking, for the number of exhibitions and animal shows held in Assam are few and far between. It was by an accident that during the Civil and Military Fraternity Week held lately at Shillong, a horse and cattle show and a dog and poultry show were included in the programme. Though these were organized more on the lines of variety performances rather than those of real animal shows, the number of animals presented was quite large. By the order of the Director of Agriculture a cow and a heifer of the Government Cattle Farm were put up in the Cattle Show. These were not meant to contest in the prizes, but to demonstrate to the public the effects of proper feeding and management. It was in the fitness of things that the prizes were given to the cows and the heifers which possessed the best points of dairy value.

Last year, a deputation of the Veterinary Assistant Surgeons of Assam met the Hon'ble Ministers of Finance and Veterinary Science and they showed by figures and calculations that by means of prophylactic inoculations and vaccinations and by treatment and other methods, they were preventing a loss of over a crore of rupees to the livestock owners of the province every year. This simple truth is hardly realized by the people who are benefited, and least by those who miss no chance in demanding early improvement of the economic condition of the general mass of the country.

About a decade back, in Great Britain, a member of the Parliament, who was also a Mayor of a County, once said in a Conference of the National Veterinary Association of Great Britain & Ireland that it was very true to say that very few people realized what a great debt the country owed to the veterinary profession. It filled such an important part in the life of each and everyone that he (the Mayor) would like to see its status among other professions rise higher and higher. He added that it was essential for the well-being of the members of the veterinary profession and for that of the whole country that everyone realized the indispensability of the veterinary surgeon. The position in our country about the realization of the indispensability of the veterinary surgeon is much worse.

MYSORE

M. L. N. IYENGAR

UNDER the special food production drive instituted early this year, about 30,000 acres will be planted under *kar ragi** and 40,000 acres under *kar* paddy during the summer of 1949. *Ragi*, the staple foodgrain of Mysore is mainly grown in the *kharif* season on dry lands. In some districts it is also raised as an irrigated crop. But this practice was practically unknown in the Irwin Canal area till very recently. Owing to the failure of the monsoon in 1945, an intensive campaign was launched to introduce the cultivation of irrigated *ragi* in the Irwin Canal tract. A large number of nurseries were raised under departmental auspices and seedlings were distributed free. Seeds and manure worth about Rs. 15 per acre were issued free to *kar ragi* growers. Special bonuses were given by the procurement agencies. Liberal prizes of the value of Rs. 6,000 were awarded to the best growers. These concessions are being extended every year. During the ensuing summer, similar concessions will be granted to *kar* paddy growers also. The prize amount has been raised to Rs. 10,000. The whole

* *Kar ragi* is generally sown in March, planted in April and harvested in mid-June releasing the land for paddy in the *kharif* season. *Kar ragi* growers are assured of adequate fertilizers for their second paddy crop.

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campaign is expected to cost the Government about Rs. 5 lacs.

Lift irrigation

Rs. 1.4 lacs have been sanctioned for special lift irrigation schemes in T. Narasipur *taluk.* Pumps are proposed to be installed along the banks of the Cauvery to bring in a considerable area under food crops in summer. The subsidy that was being paid for construction of surface wells has been increased from Rs. 500 to Rs. 1,000. More than 5,000 new wells have been completed under the Scheme since 1946. Temporary agricultural sub-depots have been opened in the *kar ragi* areas at the rate of about one depot for each 500 acres. Transport of compost to paddy lands from compost centres by Departmental trucks have been arranged for.

Irrigation in the reverse

The Krishnarajasagara dam near Mysore City is designed to hold water up to a height of 120 ft. This height is generally reached in August. But during the months of March to May, the lake level falls below 80 ft. In 1946, the then Minister for Agriculture, Sri M. A. Srinivasan conceived the idea of utilizing the large water-receded areas for temporary cultivation of food crops like *jowar.* The lands were leased to cultivators in the neighbouring villages, free of assessment and *jowar* seeds were supplied free. In the present food emergency, this campaign has again been revived this year and about 3,000 acres are expected to be sown with *jowar* in the summer 1949.

Agricultural exhibitions and competitions

The first Agricultural Exhibition in the State was held during the Dasara of 1888. Since then these exhibitions, with occasional exceptions, have become a regular feature during the Dasara festivities at the capital. A couple of years before the War, one wing of the Exhibition Buildings was converted into a permanent agricultural museum open to visitors throughout the year. After nearly five years of suspension this Exhibition was revived in October, 1948. In addition to the permanent museum a spacious stall was allotted to the Department for its exhibits and demonstrations. For the first time the Department put up a stall outside the State at the All-India Khadi and Swadeshi Exhibition at Madras in December, 1948. A special collection of agricultural produce for which Mysore is famous such as coffee, cardamom, areca, copra, tobacco, *gur* and sugar was made for the purpose. Instructive charts and maps showing the main features of Mysore agriculture were exhibited.

A scheme for awarding prizes for progressive farmers has been inaugurated recently. There are three prizes for each of the nine districts and a Championship prize for the whole State. Judging committees are being formed in all the *taluks* and the awards are proposed to be made some time in January, 1950.

Mechanization of agriculture

The Department of Agriculture in Mysore has recently launched a State-wide Tractor Service. The Department owns about 135 tractors and they have been stationed, in units of 12 to 14 tractors, in each district under a Supervisor and a tractor mechanic. These machines are hired out for ploughing at Rs. 4 per acre of virgin land and Rs. 8 per acre of cultivated land against the actual cost of about Rs. 18 per acre. The lower rates for virgin land are intended to enable the cultivators to bring more fallow land under cultivation. There is a keen and growing demand for tractor service in all parts of the State and it is therefore proposed to constitute Tractor Advisory Committees to decide questions of allocation and priority so as to get the maximum benefit from the Service.

There are at present five bulldozers in the Department. Two of them were engaged in clearing about 800 acres of scrub jungle near Closepet in Bangalore District. Two model villages, Jayapura and Vijayapura, have been laid on the site and about 450 acres of land have been brought under cultivation. Date groves, acquired by the Department for locating their regional research stations under the post-war schemes, are also being cleared by bulldozers. To extend the benefits of bulldozers to cultivators the Department is forming a corps of 24 machines. Six dozers are expected to be in commission shortly.

New rural reconstruction scheme

The State Government have inaugurated a new scheme of rural development. Under the

scheme, which was formally launched in all parts of the State in early March, rural development work is entrusted to *Taluk* and District Development Committees constituted for the purpose.* These Committees are mainly composed of non-officials although nominated by the Government. The *Taluk* Committees have roughly one member from each *hobli* (on an averge there are four to five *hoblis* in a *taluk*) The members of the State Legislature (Lower House) residing in the *taluks* are *ex officio* members of the respective *Taluk* Committees. The *Amildar* (corresponding to *Tashildar* elsewhere) is the *ex officio* Secretary and Chief Executive Officer of the *Taluk* Committees. These Committees are to meet at least once a month and have been vested with 17 executive and four advisory functions. They are competent to sanction items of work costing up to Rs. 1,000 in each case. The grants hitherto being made to village *panchayats* and for rural water supply, inter-village communication, amelioration of depressed classes, etc. will, in future, be operated by these Committees.

The Chairmen of the *Taluk* Committees in each District and five other members will form the District Development Committee. The District Committees are largely supervisory and coordinating bodies exercising control over *Taluk* Committees. They can sanction works costing between Rs. 1,000 and Rs. 5,000 under each item. The District Development Officer is the *ex officio* Secretary and the Deputy Commissioner of the District, the Chief Coordinating Authority.

At the centre, there is a Central Development Committee presided over by the Minister for Rural Development and composed of the Chairmen of District Committees, heads of all Development Departments, five Depressed Class Representatives and five other nominees. The Rural Development Department is now a full-fledged Department and its Commissioner is the *ex officio* Secretary of the Central Committee. A small Committee consisting heads of Development Departments coordinates the work on the official side. Similar coordinating bodies are proposed for districts and *taluks*.

The *Gramasudarakas* of the old scheme are replaced by Revenue Inspectors, whose jurisdiction is reduced to about 25 to 30 villages. A separate budget head and a special Rural Reconstruction Fund have been constituted.

On the material side, emphasis has naturally been laid on Agriculture and Cottage Industries. But the improvement of the morale of the people and of the spiritual side of the ryots' lives are as important if not more, and it is in the emphasis on the latter that the new scheme mainly differs from the old.

The nine popular Ministers inaugurated the scheme in the nine Districts on 6 March, 1949. The Maharaja of Mysore in a special message on the occasion expressed his hope that the village may once more become a unit as much of culture as of prosperity and happiness.

Multipurpose cooperative societies

A scheme for the organization of multipurpose cooperative societies in all the District and *Taluk* Headquarters has been prepared by the Registrar of Cooperative Societies. The main object of the scheme is to consolidate and widen the scope of the cooperative movement and bring, in a short period, almost all the villages within its fold. It is proposed to organize a society in every village having a population of 500 or more. In the initial stages, these multipurpose societies will be granted liberal subsidies and facilities for erecting godowns.

Across the Borders

TWO METHODS OF DEHORNING CALVES

By R. HENSON

THE growing practice of yarding cattle, especially dairy animals, is directing attention more and more to the advantages of dehorned stock. More such cattle can be kept in each yard, they can be handled with less risk of personal injury, and the food is shared more economically. With fattening stock there is no risk of the scars and bruises so often seen in the carcasses of horned animals. Bullying is not unknown amongst hornless cattle, but usually with the loss of their horns, horned breeds lose their fighting instinct. They can be driven through gateways without fear of that glancing blow which will rip a cow's udder and leave the way open for mastitis.

It is argued against dehorning that it is unnatural and that it spoils the appearance of our animals. Many farm practices now accepted as routine are also unnatural: lambs are docked, and male animals not wanted for breeding are castrated for good and sufficient reasons. The presence or absence of horns should not be allowed to distract attention from the points that really matter—milk or beef—neither of which has anything to do with an animal's horns. One may become accustomed to the appearance of hornless stock. Angus and Red Poll fanciers would not think their cattle improved if horns were grafted on. It is not their horns that give the Ayrshires a high place in the dairy world; it is their udders and their ability to produce milk. American and Canadian practice is more and more tending towards dehorning all cows.

The dehorning of older cattle requires the services of a veterinary surgeon; because of the pain involved it is done under an anaesthetic. Inevitably the animal suffers from shock, with at least some temporary loss in production, and there is always the danger of bacterial infection of the frontal sinus. The best time to dehorn, therefore, is before the horns have begun to grow, that is, in the first week or two of the calf's life. For some time it has been felt that the old methods of dehorning are not as satisfactory as they might be. Caustic soda or potash sticks have many disadvantages. They need very careful handling and it is easy to use too much and so cause excessive burning—even damage to the calf's eyes by drainage from the treated site.

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Guthrie[1] (1947), after preliminary tests with various dehorning agents, found that a flexible collodion solution of antimony trichloride gave the most satisfactory results. He claimed that this material was easy to apply and that the solution dried quickly into a firmly adhering flexible film which destroyed the underlying tissue with much less pain than the alkaline dehorning agent. He also maintained that there was no 'weeping' of fluid to endanger the eyes. The formula recommended by him was:

	Per cent
Antimony trichloride	28
Salicylic acid	7
Flexible collodion	65

Another method of dehorning calves is by cautery. Rowe[2] (1947) was reported to have adapted an electrical soldering iron to form an efficient cauterizer, and this had obvious advantages over a fire-heated iron. The solid metal end of the iron was hollowed out to form a ring 1/8 in. thick, 5/16 in. deep, and with an internal diameter of ½ inch. The iron, heated by electricity, was held over the developing horn bud to sear a complete ring of tissue around it and thus prevent growth.

A test of these two methods has been made. The primary objects were to discover:

(i) The amount of irritation,

[1] Guthrie, J. E., *Vet. Med.* (1947) 42, 8.

[2] Rowe, J. E. *Farmer and Stock Breeder* (1947) Oct. 14, p. 2319.

(ii) The relative efficiency of the two methods.

(iii) The most suitable age for the operation.

By chemical agent

Twelve Dairy Shorthorn, Ayrshire and cross-bred calves of ages varying from 2 days to 5 weeks were treated. The hair was first clipped away from the horn bud and the area cleansed by a swab dipped in spirit. The preparation was then applied, care being taken not to touch the surrounding skin. The area covered was roughly the size of sixpence. As the solution will corrode metal, a wooden-handled brush, such as is used for glue, was found to be the best method of application. The solution dried very quickly to form a skin over the area.

One calf, No. 7 (see Table I), was clipped but not cleansed before applying the agent. This calf showed signs of irritation and a tendency to rub the affected area against the rails of the pen. There was slight growth of one horn. The younger the calves when treated the less was the irritation. With the exception of No. 7 those dehorned at ages up to 10 days showed little sign of discomfort. Older calves showed signs of pain, especially Nos. 1 and 2. These calves had well-established horn growth, and much more of the solution had to be used on them than on the younger calves. There was no pain whatsoever at the time of application.

TABLE I

Calves treated with chemical agent

Calf No.	Breed	Age when treated	Age when last observed	Visible horn growth		Remarks
		Days	Weeks	Right	Left	
12	Ayrshire ..	2	12	None	None	
6	Shorthorn ..	4	16	,,	,,	
7	Ayrshire ..	6	15	Slight	Slight	Horn buds not cleansed
9	Shorthorn ..	7	14	None	None	
5	,,	8	12	,,	,,	
8	,,	9	14	,,	,,	
4	Ayrshire ..	10	18	Slight	,,	
11	Shorthorn ..	11	18	None	Slight	
10	,,	13	18	Strong	None	
3	Ayrshire ..	18	11	,,	Strong	
1	Cross-bred ..	28	20	,,	,,	
2	,,	35	20	,,	,,	

Table I shows the results of the treatment of the twelve calves. With those noted as showing strong horn growth, there is no sign of checking at all. Those marked 'slight growth' have a thickening or swelling at the site of the horn which, however, has shown very little growth in three months. Those indicated as having no growth show no signs of horns; the hair has grown over the area and to all appearance they might have been born naturally polled.

Age

The amount of horn growth at a particular age varies with the breed and with individual animals. Some calves will have no more horn growth at 14 days than others at 2 days. Nevertheless, the best time of treatment to obtain consistent results would seem to be within the first week, preferably the day after calving. The horn bud can then just be seen and can be destroyed with a minimum of solution. The older the calf the more likely it is to rub, as there is more tissue to burn and, therefore, more irritation; moreover, an older calf is more sensitive.

By electrical cauterizer

The iron was connected by a three-point 5-amp. plug, since it is important to earth these irons to avoid any risk of shock to either the operator or calf. It was not found possible to overheat the iron; indeed at the 'peak periods' of the day it was difficult to heat the iron sufficiently. The operation is easier if the hair is clipped away from the horn bud first; but this is not essential. Pre-clipping also saves the iron from becoming covered with half-burned hair, as it would be where several calves have to be done.

The iron was held to each horn bud momentarily and then the operation repeated. In practice it was found to be impossible to burn the calves too much; their struggles inevitably dislodged the iron as soon as its work was done. When the operation was finished there was a complete ring of seared tissue around the horn bud. The operation is, of course, momentarily painful but the calf appears to feel no distress afterwards.

Table II gives the results of the six calves treated. The four younger calves on which the treatment was successful look as if they

are naturally polled. Calf No. 15, noted as having 'some growth' has thickened, blunted horns, far shorter than normal. Calf No. 16 is developing normal horns.

TABLE II

Calves treated with the electrical cauterizer

Calf No.	Breed	Age when treated Days	Age when last observed Weeks	Visible horn growth Right	Visible horn growth Left	Remarks
18	Cross-bred	4	14	None	None	
17	Ayrshire	7	12	,,	,,	
13	Cross-bred	18	15	,,	,,	
14	,,	21	20	,,	,,	
15	,,	28	26	Some	Some	
16	,,	35	26	Strong	Strong	

Here again, the earlier the operation the less tissue there is to sear away and therefore less pain to the calf. Also, the younger the calf the easier it is to hold. One calf was successfully treated at 4 days, but a week to 3 weeks seems to be the optimum age; that is as soon as there is sufficient growth to hold the iron in position.

Discussion

Both methods proved satisfactory, provided they were carried out within certain prescribed age limits: 1 to 9 days for the chemical dehorner and 4 to 21 days for the cauterizer. The chemical dehorning agent has two outstanding advantages over the electrical cauterizers: (1) The operation can be performed anywhere the calf may happen to be lodged, whereas the other method requires a supply of electricity, the presence of a convenient power point, and haltering and leading the animal to that point. There is also the time taken for the iron to heat, which is anything from 15 to 30 minutes. (2) Although there are three operations involved in using the solution, all are simple and practically painless, and they can be done by one man if necessary. With the cauterizer, although it is not necessary to prepare the site first, two men are required, and sometimes even then the calf is difficult to hold.

The chemical method has one disadvantage. If any of the solution is accidentally placed on the surrounding skin the irritation may cause the calf to run the area and thus impair its action, but this may be obviated by carefully wiping off any such solution immediately.—Reproduced from *Agriculture*, January, 1949.

PRESERVATIVE FOR *NEERA*

AS a result of experiments in the Indian Institute of Sugar Technology, Kanpur, a preservative for *neera* (sweet palm-juice) has been found. By application of this preservative, *neera* does not undergo any fermentation for a number of days and can safely be used as a non-alcoholic drink. It can be transported over long distances without any effect on the quality.

The amount of preservative required to be added is very small and does not cost more than one pice per maund of *neera*. *Gur* can be manufactured from *neera* thus preserved, without any loss of sugar. The preservative has no colour or taste and is harmless.—*P.I.B.*

Home Gleanings

USE OF POTATO CHIPS, EYES, AND SPROUTS AS SEED

By M. J. DESHMUKH

ALTHOUGH it was common knowledge that propagation of potatoes from small pieces of a whole tuber was possible under suitable conditions, its practical utilization was first taken up in the U.S.S.R. during the World War II. War conditions made it necessary to increase the area under potatoes in the U.S.S.R. because they furnish more food and industrial raw material per acre than any other crop. The supplies of seed, however, were insufficient to allow much expansion. The shortage was overcome by using potato tops (a small piece with an eye cut from the rose end of the tuber, the piece being nearly 1/10th in size of the whole tuber) as seed and using the remaining portion (nearly 90 per cent) for food or processing purposes. The method was elaborated by Prof. Lysenko and his co-workers at the Lenin All-Union Agricultural Academy[1]. In 1942 a total of nearly 3,80,000 acres were reported to have been planted with tops in various parts of the South-east and Centre of the U.S.S.R. and the yields from the tops were not inferior to those of potatoes planted in the usual way, and in regions where ring rot is prevalent plants grown from tops were reported to be less liable to the disease than those from the seed. The idea was carried still further by Prof. Yakushkin of the Timiryazev Agricultural Academy, Moscow, who planted an eye itself with a small piece of flesh attached and obtained encouraging results[2].

Subsequently this line of work was undertaken elsewhere with a view to evaluating the suitability of this new method. Evans[3] (1943) in England found that whereas tops (1 in. in diameter, 1/14 in. in thickness at the thickest part, planted 12 in. apart in rows 2 ft. 6 in. apart and at a depth of 2 in. to 3 in. in the soil) yielded 526 lb. of tubers from 1/60th of an acre, the whole tubers yielded 613½ lb. under similar conditions. He calculated that only 3 cwt. (nearly 4 maunds) of tops would be required to plant 1 acre against 13 cwt. (7·18 maund) of whole tubers. Copisarow[4] (1943) reported that 288 tops (each of ½ in. diameter, ¼ oz. in weight, planted in boxes) from 24 lb. of potatoes gave 804 tubers weighing 172 lb., each plant yielding nearly 10 oz. Pal and Deshmukh[5] (1944) conducted experiments in India. They found that whereas 100 plants raised from whole tuber of Phulwa (each tuber approximately weighing 21·45 gm.) yielded 51·5 lb., 100 plants raised from tops (each weighing 4·2 gm.) yielded 33·4 lb., 100 plants raised from 'eyes', on the other hand, yielded only 18·7 lb. As a result of these preliminary observations it was thought possible to improve the yields from tops under suitabtle spacing and manuring. Accordingly an experiment initiated (Pal and Deshmukh, unpublished work) in 1944-45 with 3 spacing (1½ ft.×6 in., 1 ft.×6 in.) and 3 manurial treatments (no manure, a manurial mixture before planting and the same after planting) was conducted for three years. The results indicated that tops of Phulwa yielded slightly less than whole tubers under all treatments. Sen and Chakravarti[6] (1945) confirmed the earlier results of Pal and Deshmukh (loc. cit.).

Polunin[7] (1943) drew attention to the use

1 Anon., Soviet scientific work on potatoes, *Nature*, **150**, 456-457, 1942.

2 Garner, H. V., Intensified potato culture in the USSR, *N. Min. Agric.* **50**, 20-21,1943.

3 Evans, G., Potato eyes as readily transportable seed for the colonies, *Nature*, **152**, 464-466, 1943.

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4 Copisarow, M., Potatoes and war economy, *Nature*, **151**, 421-422, 1943.

5 Pal, B. P. and Deshmukh, M. J., Potato tops and eyes as seed, *Curr. Sci.*, **13**, 309-311, 1944.

6 Sen, B. and Chakravarti, S., Potato seeds from chips, *Curr. Sci.* **14**, 44-46, 1945.

7 Polunin, N., Economical Potato propagation with remarks on detached sprouts, *Gardeners' Chronicle*, **113**, 36-37, 1934.

of detached sprouts as seed. He took sprouts 4½ in. in length and planted them in boxes. He obtained nearly 6·5 lb. from eight plants raised from sprouts.

Pushkarnath[8] (1945) conducted detailed experiments on potato sprouts as a source of seed. According to him the sprouts, when they are about 1 in. to 2 in. in length, are detached from the tuber and planted in a nursery 3 to 4 weeks earlier than the normal time of planting and transplanted in the field when the sproutlings are 4 in. to 6 in. in height. At Simla the yields obtained from them were reported to be as good as those from whole tubers. The use of sprouts as seed is already proving very helpful in rapidly building up the stocks of new potato varieties or hybrids at the Potato and Wheat Breeding Substation, Simla.

Two important questions emerge out of the above observations. Firstly, do the plants raised from smaller sets, i.e. tops (chips), eyes, sprouts, etc. yield as well as those raised from the whole tubers? If this is possible then, the second problem refers to the commercial utilization of this method, including method of storage, transport and cultivation. If the smaller sets can be profitably used as seed on a commercial scale, there would be considerable saving in seed and consequently an increase in food. Also if suitable methods of their storage and transport are developed, there would be a great economy in storage and transport expenses.

Experiments so far done in India have indicated that the chips (tops) and eyes do not yield as well as the whole tubers. Although Pushkarnath found the yield from sprouts as good as from whole tubers, experiments done at the Division of Botany, Indian Agricultural Research Institute, New Delhi, and at Kanpur (Mitra, 1947, personal communication) have not given such good results. It must, however, be borne in mind that Pushkarnath conducted his experiments under the conditions of the hills which are quite different from those prevalent in the plains for potato cultivation. In this connection Bushnell (1930) observed that there was a gradual decrease in the yield of potatoes as the chips (used as seed) decreased in weight from 15 gm. below. In his opinion if the chips have to give favourable yields, each of them must weigh at least ½ oz. and should be 7/8th of an inch in thickness in the centre. In the experiments so far conducted in India, chips of much smaller weight have been used as seed. Purewal[9] (1947) also obtained similar results with potato peelings and chips. He stated that the loss in yield from smaller sets was much more than the saving effected in the quantity of seed planted. Work on smaller sets is also being conducted at the Bose Research Institute, Calcutta, but no published record of the work was available to the writer.*

Therefore, it has yet to be established whether the chips, eyes and sprouts can yield as well as the whole tuber under Indian condition. However, these smaller sets can be profitably used for the rapid multiplication of new varieties the material of which is very limited at the beginning.

Much work has been done on the methods of storage and transport of such smaller sets. Scannell[10] (1937) has referred to the certified seed 'potato eye' trade in Canada. He states that this trade started about 25 years ago in the Prairie Provinces. He further states, 'Conditions were quite different then to what they are now. Settlers were moving into all

8 Pushkarnath, Potato sprouts as a source of seed, *Curr. Sci.* **14**, 236-237, 1945.

* Investigations were conducted at the Bose Research Institute by Dr B. K. Kar with a view to find out (1) a method for preserving the cut chips of varying sizes 1 cm. to 2·5 cm. over a longer period and prevent them from desiccation; (2) to find the growth and yielding capacity of the chips—severed from the mother tuber at different periods of their preserved life from the harvesting time to the sowing time; (3) to find out if the severed sprouts from mother tuber can be practically utilized for propagation.

Attempts were made to prevent excessive desiccation by suberizing the cut surfaces or by covering the cut surfaces with a special mixture of shellac-wax—India rubber and then storing them in a refrigerator. Sealed chips showed less desiccation and sowing experiments also showed better germination and yield dependent, however, upon (1) time of severance from the mother tuber; and (2) period of preservation. Germination percentage, growth and ultimate yield increased, with shorter the period of life of the chips separated from the mother tuber with consequent loss of desiccation and period of preservation. But the yield from the chips was found to be less than the normal sowing. The severed sprouts were not found practical for propagation. (loc. cit.—Ed: Sci. & Cul: and also refer—Isolated potato eyes as seeds for propagation by B. K. Kar, *Ind. Jour. Hort. Soc.* **II**, 41, 1944.)

9 Purewal, S., Potato buds as seed, *Punjab Fruit J.*, **11**, 253-255, 1947.

10 Scannell, J. W., Development of the certified seed 'potato-eye' trade, *Amer. potato J.*, **14**, 23-25, 1937.

parts of Western Canada and many of them were a good many miles from railways. By cutting potato eyes and mailing them good seed was made available to settlers in all parts of the country'. According to Scannell the eyes are cut from the tubers by three methods:

(i) An instrument resembling an apple corer: the corer is placed over the eye and pushed through the tuber making a cylindrically shaped set with an eye at least at one end. The borer is an inch in diameter and the length of the set is governed by the size of the tuber: 10 sets weighed $6\frac{1}{2}$ oz.; (ii) A potato parer bent into a semi-circle: this method produces sets of a conical shape and of small size: 10 sets weighed 2 oz.; (iii) A vegetable baller: it is a kitchen utensil. The eyes are cut in semi-circular form, approximately an inch in diameter and an inch across at the deepest point: 10 sets weighed 4 oz. The sets are thoroughly coated with slaked lime to prevent drying out and shrinking and can then be kept for several weeks without any apparent deterioration. Later, they are boxed or rolled in oiled paper for transport. It is estimated that in the spring of 1936 nearly half a million eyes were sold in Western Canada. According to the third method of cutting one bushel (60 lb.) of Irish Cobbler variety gave about 1,000 eyes. After the saleable eyes have been removed the remainder of the tuber is used for planting. Scannell further reports that very satisfactory yields were obtained by using seed potato-eyes.

Evans (loc. cit.) undertook experiments to develop a method of despatching potato chips by air with reasonable assurance that when planted they would be capable of giving a fair crop. Allowing for reasonable delays in packing, despatch and distribution, it was considered that the chips would have to retain viability for about a month. According to him the tuber is held in the left hand and a thin chip (1 in. diameter, $\frac{1}{4}$ in. thickness in the centre) cut off the rose end with a sharp knife. The chips were collected and placed with cut surface upward on shallow trays, the bottoms of which were covered with a thin layer of peat-moss litter. The trays were placed in shelves in a wooden seed store-room at ordinary temperature. The chips 15 days old gave 80 per cent germination and had shrivelled to nearly half the original size. He calculated that 112 lb. of such dry chips would be necessary for planting one acre.

Marritt[11] (1944) described treating, packing and storing potato eye-sets. According to him, eye-sets are becoming an increasingly important factor in the seed potato trade in Canada because they can be widely distributed at little cost. The eyes are scooped out ($\frac{1}{3}$ oz. in weight, 7/8 in. in thickness in the middle) with a vegetable baller; they are then washed out in clean water; soon after that they are packed in moisture proof paper. A wax-coated carton wrapped with waxed craft paper is considered a standard package containing 25 eyes. The eye-sets are then stored at about 77°F., for 4 days to a week and then at 38°F. until shipped. After they reach the destination they are again stored at 35°F. till planting.

Nattrass[12] (1945) has summarized the position regarding the healing of the potato pieces. If cut surface is exposed to dry air, it forms a hard crust which readily cracks. There is a considerable shrinkage and loss of moisture. If on the other hand the cut surface is kept in a moist atmosphere, 12–36 hours after the walls of the cells immediately below the cut surface become covered with a deposit of suberin which form a continuous layer blocking the cut surface. This not only prevents loss of moisture but effectively bars the way to rotting organisms such as bacteria and moulds. Within a further period, the duration of which depends on the variety and the temperature, the cells immediately below the blocked surface divide to form a layer of suberized cells which eventually develops into a skin similar in structure and function to the outer skin of the tuber.

The natural healing process can be induced by keeping the cut pieces in a moist atmosphere for 2–4 days after cutting. This can be done by placing the cut pieces in a shallow layer and keeping them covered with moist sacks. The properly healed sets can withstand exposure almost as well as mature whole tubers. Nattrass found that nine months after cutting, the cut pieces were in excellent condition. By this method there is not much loss in weight. Four chips weighing 40 gm. underwent only 23 per cent loss in weight after healing while by Evan's method the reduction in weight is nearly 50 to 60 per cent. But by this new method the chips can be stored for a long period.

11 Marritt, J. W., Treating, packaging and storing potato eye-sets, *Sci., Agric.* 24, 526-532, 1944.
12 Nattrass, R. M., The cutting and treatment of seed potatoes, *East African J.*, 11, 83-85, 1945.

These pieces have been successfully sent by air from Kenya to England.

At Simla detached sprouts have been found to retain their viability for a week when placed in moisture-proof packets.

The position regarding the use of smaller sets of potato, i.e. chips (tops), eyes and sprouts for seed may be briefly summarized. Experiments so far conducted in India have indicated that the smaller sets generally yield less than whole tubers. One of the reasons for such low yields of the smaller sets may probably be that the sets used by the workers in India have been invariably less than ½ oz. in weight; according to Bushnell (loc. cit.) such small sets give correspondingly low yields. This then means that more elaborate experiments are necessary to evaluate the potentiality of the smaller sets. It is quite possible that sets of suitable size, if planted with proper spacing and manures, may give yields which may favourably compare with those from whole tubers. Although the work at Simla has shown that the sprouts can be profitably used for rapid multiplication of improved varieties, more extensive work, particularly in the plains, is necessary to evaluate the possibility of its commercial utilization.

Although sufficient work seems to have been done abroad on the problems of storage and transport of smaller sets, it will be necessary to work out these problems for the conditions prevalent in India both in the plains and the hills. Also it will have to be seen how far the disadvantages of low yields of smaller sets and items of additional cultivation like preparing and raising a nursery and transplanting, particularly in the case of sprouts, will balance the advantages of small quantity of seed (which means saving in food, low costs of seed and storage) and low transport expenses.

If, therefore, smaller sets of potato, particularly the chips of suitable size give fair yields, and if suitable methods of their storage and transport for local conditions are worked out, it will help to a great extent towards the expansion of potato acreage in India. And more potatoes means partial fulfilment of an urgent need of the nation, more calories per capita per day.—Reproduced from *Sicence and Culture*, May, 1949.

HALF TON OF POTATOES FROM TWO POUNDS OF SEED

WHAT is believed to be a record potato yield for Australia was established in the 1949 season by Mr. C. B. Powell of Clarendon, South Australia. From 2 lb. of seed potatoes, he grew 1,336¼ lb. of tubers, a ratio of 668⅛ to 1.

The variety planted was the recently introduced American Sebago, which has become very popular in the hill districts of South Australia during the last two seasons.

Seed was cut into 163 sets, of which 152 grew to maturity. Digging and weighing of the crop was supervised by members of the Agricultural Bureau.

Tubers from 14 plants in an average row filled a sack weighing 148 lb., an average of approximately 10½ lb. a plant, but one individual plant produced 18 lb. of potatoes, some of which weighed 3 lb.—*Australian Agricultural Newsletter*, No. AGN/249.

Book Reviews

SOIL EROSION—ITS PREVENTION AND CONTROL

(Published by the Government of Madras, 1948.)

THE rapid depletion of the soil resources of India by erosion and the subsequent effects in lowering the general standard of living of the masses has only recently been realized by the governments in India. Any book, at this juncture, which would create real interest in the country on soil erosion and its control is, indeed, welcome. The Madras Government is to be congratulated for having taken a bold step in bringing out a text-book on soil erosion for the use of Departmental Officers and for teaching the subject in the Agricultural and Forest Colleges.

The subject matter of the book is divided into eighteen chapters and is profusely illustrated. Lessons of the past as well as of modern times of soil erosion have been presented in Chapter I. Examples of damage caused by erosion in different parts of the world have been cited. The chapter begins with a definition of soil which is hardly apt. A definition of soil could have been more precise as the one given by Joffe—'The Soil is a natural body, differentiated into horizons, of mineral and organic constituents, usually unconsolidated, of variable depth, which differs from the parent material below in morphology, physical properties and constituents, chemical properties and composition and biological characteristics'. In addition to the description of the destructive processes leading to the accumulation of soil materials, the constructive aspect of soil formation leading to the development of soil profiles should have found a place.

Chapter II deals with the agencies and the types of erosion that are generally met with. The results of erosion in silting up of reservoirs and irrigation canals, reduction in underground water supply, etc. are also broadly dealt with. The chief causes of accelerated erosion are given in Chapter III. Nine causes are enumerated but only four of them have been explained in some detail. Under 'soil variable qualities', only the texture and the structure of soils have been dealt with. But other soil characteristics such as soil depth, permeability, nature of colloids, etc. which are significantly correlated with the erodibility of soils, are not touched upon. An elucidation of these factors would certainly add to the value of the book.

Chapter V is well-written and contains much useful information. The question whether 'waste weirs', even in contour bunds, are necessary or not, is still a moot point. The intensities of rainfall as also the peculiar characteristics of the Black soils of Karnatak do call for, if not waste weirs, some other mode of excess-water disposal. In Chapter VII, the items of dry farming and terracing have been discussed. Soil and moisture conservation problems are interdependent and a great deal of work has been done in India. Hence the subject of dry farming might have usefully been discussed in greater detail in this chapter. The subject of terracing could have been dealt with in more detail and also discussed in Chapter V along with contour bunding. Such important questions as the 'uniform grade' and 'variable grade' terraces, their length and cross sections should find a place in a text-book.

Chapter X dealing with the agronomic or the biological aspect of erosion control has been treated cursorily. The effects of various types of mulches and the place of legumes and grasses in erosion control practices are not fully emphasized. The method of laying out contour strip cropping on the land, selection of suitable cover crops, their seed rate, width which could be adopted with advantage in different soil types, slope, climatic complexes and their ultimate effect in soil development and increased crop production need to be dealt with in a text-book of this kind. In the suggested land-use recommendations in this chapter, only slope and degree of erosion have been taken into consideration. A major factor such as soil type, which is vital for any land-use planning has been left out.

In Chapter XII, XIII and XV the questions of types of dams and the control of stream and river bank erosion have been compiled very satisfactorily. The last chapter dealing with erosion and malaria although of vital importance to India occupies, for a text-book

on soil conservation, too much space. Lastly in this volume, one vital omission is a chapter wholly dealing with *soil conservation survey* of all cultivable areas including suggestions for land classification and land-use planning. No text-book could be considered complete without it. Otherwise, the volume is on the whole, timely, well written, definitely informative and useful. The subsequent volumes to follow on the subject may well be expected to be more comprehensive. The minor printing errors, not a few, are common with all our printers. (J.K.B.)

COMMERCIAL FRUIT AND VEGETABLE PRODUCTS

By W. V. Cruess (Published by McGraw, Hill Book Company, New York, 3rd Edition, 1948, pp. 906, $ 8·5)

THIS internationally distinguished author and his well-read book need no special introduction to the readers. His book has served for over twenty-four years all students of food technology and horticulture and in this third edition the author has put in lots of new material and data as well as many new illustrations. These represent developments in the various phases of the science of food technology during the past many years especially in canning, freezing and dehydration. A singular addition to this new edition is the chapter on 'Plant Sanitation' which deals with a very essential and important aspect of food processing, particularly in the recent years. All the materials have been presented up to date.

The book has covered all the principles and commercial applications of canning, freezing and dehydration of fruits and vegetables, beverage making, manufacture of jams, jellies, marmalades, fruit and vegetable concentrates, pickle making, wine and vinegar making, etc. Some chapters cover the various aspects of spoilage and their control, utilization of waste fruits and vegetables and disposal of wastes. An interesting chapter on packing cases and other methods of packing has also been briefly presented. At the end of each chapter a useful reference list of books, bulletins and original articles on the various subjects has been given, which will be of considerable help to those who want to go into details.

The subject of fruit technology has shown great progress and possibilities and it is rather difficult to write a single and comprehensive book covering canning, freezing, dehydration, etc. since each one of the branches might well be dealt with in a separate volume. In this edition credit goes to the author for presenting the whole field in a instructive and informative manner, giving most of the up-to-date details on the various branches of fruit technology without sacrificing any of the fundamental principles and fresh advances.

The book is recommended to all those engaged in the fruit industry as well as to all the students and teachers of fruit technology. It is the only outstanding 'all-in-one' compilation so far available dealing with all the processes involved in the manufacture of fruit products and in fruit preservation. The fruit world must be greatly indebted to the author for putting his life-time study and energy in this new edition for its benefit. (G.S.C.)

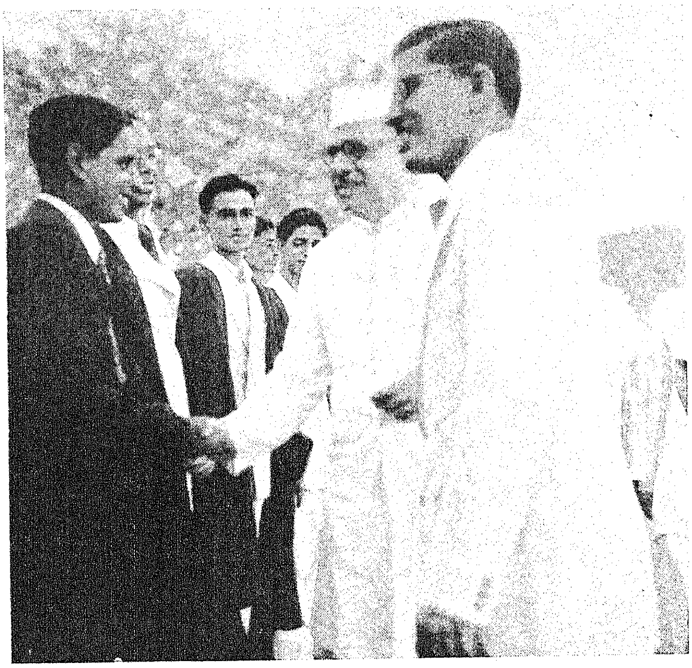
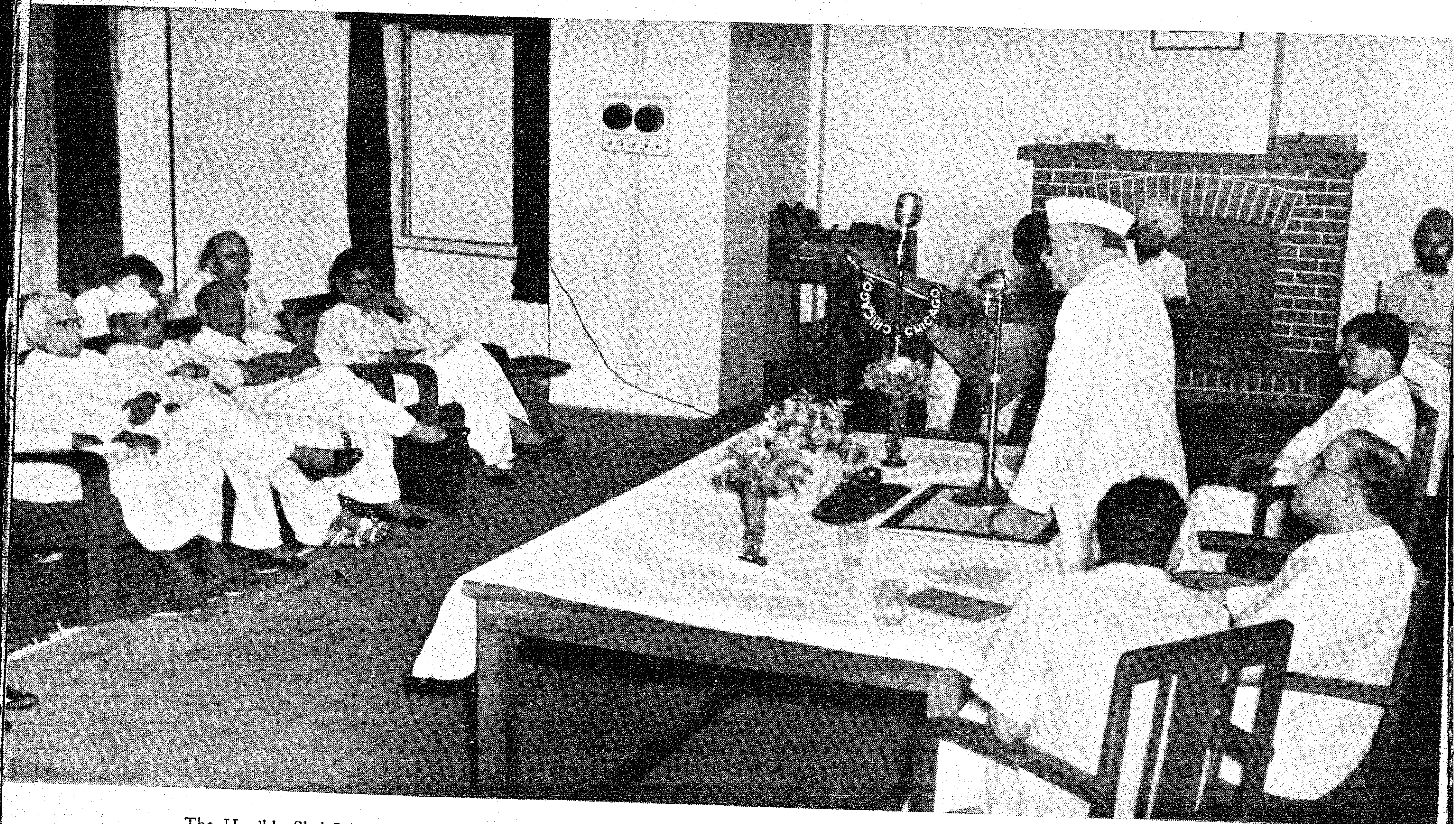


FIG. 1. The Hon'ble Shri Jairamdas Daulatram meeting the teaching staff. Photo G. C. Sharma.



The Hon'ble Shri Jairamdas Daulatram addressing the Second Annual Convocation for the award of diplomas to the students of the Statistical Training Courses of the Indian Council of Agricultural Research.

News and Views

I. C. A. R. CONVOCATION

THE Second Annual Convocation for the award of certificates and medals to the students of the Statistical Training Courses of the Indian Council of Agricultural Research was held at the Constitution Club Hall, New Delhi, on the evening of 4 May, 1949, before a distinguished gathering. The Convocation was presided over by the Hon'ble Shri Jairamdas Daulatram, Minister for Food and Agriculture. All the students and the teaching staff appeared in academic gowns. Sardar Datar Singh, Vice-Chairman of the Council, was unavoidably absent but the speech which he prepared for the occasion was read out by Shri S. M. Srivastava, Secretary of the Council. In his welcome address Sardar Datar Singh explained that the Training Courses provided training for two groups of students. The first group consisted of research workers in agricultural and animal husbandry sciences whose primary interest was not statistics but for whom statistical methods were important tools of research. The second group comprised of those who had statistics as their primary interest, and who were to earn their living as professional statisticians in agricultural and animal husbandry institutes and Departments of Agriculture in the provinces and at the Centre. The first group of students, who were usually officers deputed by the provincial and State Governments for statistical training, had a shorter course extending over a period of nine months split into two terms of four and half months each. For the second group of students, two courses of training were prescribed, namely, the Certificate and the Diploma Courses. A student of the Certificate Course was expected to acquire mastery over the fundamentals of statistical science and its application to agriculture. Students successfully completing the Certificate Course as also a few others with high academic qualifications in Statistics were allowed to go in for the Diploma Course which required acquaintance with methods of advanced and regional research. The requirements of this course corresponded to that of a Doctorate Degree of an Indian University. Sardar Datar Singh announced that the Food and Agriculture Organization of the United Nations were proposing to set up an International Training Centre under the Indian Council of Agricultural Research for training of delegates from Asian countries in census methods in connection with the forthcoming F.A.O. agricultural census.

After this welcome speech, Dr Sukhatme, under whose direction the Training Courses are organized, read out his annual report describing the activities of his section during the past year. In his report he referred to the difficulty of advanced students having to leave off their studies due to financial or other considerations. This, he said, was a loss to the cause of statistical research as a whole and he pleaded that certain research scholarships on the lines of those available in the Universities for advanced research should be available to the successful and promising students in these Training Courses so that they could be employed as research scholars for carrying on original and advanced research in statistics.

After the report was read, the Honourable Shri Jairamdas Daulatram gave away the Certificates. The names of the following successful students are mentioned below:

Short Course

1. Mr. G. D. Chakrabarty.
2. Mr. P. R. Yeri
3. Mr. R. Devarajan
4. Mr. A. C. Mathur
5. Mr. A. G. Kavitkar
6. Mr. J. C. Victor
7. Mr. K. N. Vali
8. Mr. Gurdial Singh
9. Mr. Vidya Sagar
10. Mr. M. L. Shukla
11. Mr. K. S. Sinha

12. Mr. M. Gangarudriah
13. Mr. J. S. Srivastava
14. Mr. C. C. Das
15. Mr. A. Sitarama Rao
16. Mr. B. P. Patel
17. Mr. R. N. Chaturvedi
18. Mr. P. K. Chakrabarty

Certificate Course

1. Mr. B. V. Sukhatme
2. Mr. Faqir Chand
3. Mr. K. V. R. Sastry
4. Mr. R. S. Asthana
5. Mr. C. V. Rao
6. Mr. Daroga Singh

Diploma Course

1. Mr. P. N. Saxena

Shri B. V. Sukhatme and Shri P. N. Saxena were awarded a gold medal each for standing first in the Certificate and Diploma Courses respectively.

The Hon'ble Shri Jairamdas Daulatram then delivered his convocation address*. (D.J.S.G.)

*The address is printed as the leading article in this issue.

TESTING COTTON TEXTILES AND CORDAGES FOR RESISTANCE IN ATTACK BY MICRO-ORGANISMS

TEXTILE materials are liable to deterioration by the action of micro-organisms like bacteria and fungi, in transit, in storage or in use. Such deterioration is facilitated by the climatic conditions prevalent in tropical countries like India. The need for protection of textiles from the attack of micro-organisms and procedures for the evaluation of resistance conferred by suitable treatments are clearly essential.

The Textile Division Council of the Indian Standards Institution has, therefore, brought out the Draft Indian Standard Procedures for Testing Cotton Textiles and Cordages for Resistance to Attack by Micro-organisms. It has been prepared by the Textile Chemistry Sectional Committee, composed of technologists and producers in the textile industry in India under the Chairmanship of Dr T. S. Subramanian, Superintendent, Technical Development Establishment Laboratory (Stores), Kanpur.

The procedures described in this standard are applicable to cotton textile materials like plain and water-proofed fabrics, webbing, yarns and cordages and serve to assess the resistance of these materials to attack by micro-organisms. The methods also hold good for textiles which have received treatments aimed at increasing their resistance to micro-organisms. These methods of test can, therefore, be applied for the evaluation of compounds and treatment processes designed to protect textile fabrics and cordages from damage by micro-organisms.

Three principal methods of test have been described in this specification, viz. the Accelerated Mildew Infection Method, Aspergillus Niger Method, and Soil Burial Method. There are seven appendices detailing experimental procedures to be adopted for the tests laid down in the standard.

In accordance with the procedure of the Indian Standards Institution, every draft specification or code prepared by a Sectional Committee or Sub-Committee, after its approval by the Sectional Committee, is to be issued in proof form for a period to be determined by the Committee but not less than three months and widely circulated amongst those likely to be interested, for the purpose of securing critical review and suggestions for improvement. Comments received from all quarters shall be given due consideration by the Sectional Committee; and the revised final draft will then be put up to the Textile Division Council for endorsement. Before being finally accepted as an Indian Standard it must be approved by the Executive Committee and the General Council of the Institution.

The draft has accordingly been widely circulated to industrialists and technologists in the field. Comments will be received up to 30 June, 1949 by the Director, Indian Standards Institution, Block 11, Old Secretariat, Delhi 2.

DRAFT INDIAN STANDARD ON WOOL FOR EXPORT

BY far the most urgent and important problem that confronts the Indian wool-exporting industry today is the variability and, more or less, uncontrolled quality of the wool that is being sent out of the country. The adverse effect of such a procedure on the reputation and on the economic returns to the industry is fairly evident.

An effective remedy that would help the industry to grow on sound lines is to standardize the various grades of exportable wool and to ensure that the exported product conforms to those standards. The importer abroad, being thus assured of uniform quality of wool in the respective grades, can confidently trade with the country, and will perhaps be ready to pay a premium for such assurance.

With these objects in view the Textile Division Council of the Indian Standards Institution has drawn up a draft Indian Standard Specification for Grading of Wool for Export. This standard applies to wool produced in India, and specifies grades both according to colour as well as quality. Specifications for packing and marking are also included.

In accordance with the procedure of the Indian Standards Institution, every draft specification or code prepared by a Sectional Committee or Sub-Committee, after its approval by the Sectional Committee, is to be issued in proof form for a period to be determined by the Committee, but not less than three months, and widely circulated amongst those likely to be interested, for the purpose of securing critical review and suggestion for improvement. Comments received from all quarters will be given due consideration by the Sectional Committee; and the revised final draft will then be put up to the Textile Division Council for endorsement. Before being finally accepted as an Indian Standard it must be approved by the Executive Committee and the General Council of the Institution.

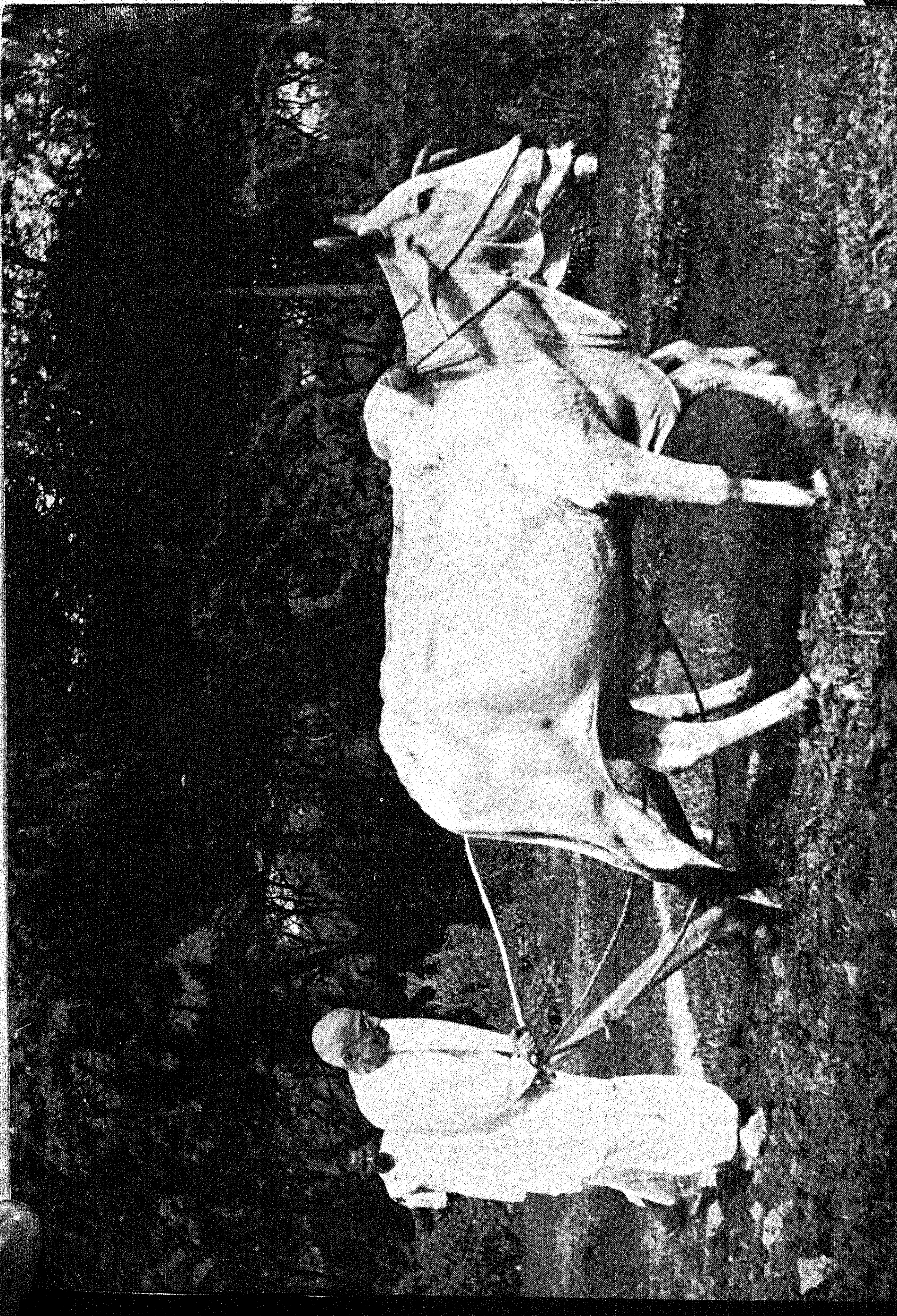
This draft standard is being circulated among wool producers, exporters, manufacturers and other interests who are likely to be interested in the subject of the standard. Comments will be received till the end of May 1949 by the Director, Indian Standards Institution, Block 11, Old Secretariat, Delhi 2.

COVER ILLUSTRATION

A lotus lake at Dosuya,
District Hoshiarpur

—Photo N. S. Bisht

Parts of the Governor-General's Estate has now come under cultivation. The old-fashioned bullock-plough and the modern tractor are both being used in the Estate. Picture on the reverse shows His Excellency Shri Rajagopalachari at the plough.



INDIAN FARMING

SEPTEMBER, 1949

Vol. X No. 9

PRODUCE ALL THE FOOD WE REQUIRE*

WHEN I was in Simla last month for a week's holiday, I invited those who expressed a desire to see me to what is called an At Home. In the old days an At Home meant alcoholic drinks. But now of course no such thing is possible. We had some soft drinks and what was permissible under the Entertainment Laws by way of chewing. We had asked everyone who had signed his name without looking into his rank or profession. So that I was able to see the glad faces of nearly fifteen hundred Simla residents that evening.

The report of this gathering in the newspapers alarmed some good men who thought I had called together fifteen hundred men and women and feasted them in old Viceregal Lodge and wasted a lot of food when there was so much talk of shortage and appeals for austerity. They did not know that we spent not one ounce of rice or wheat or millet or of pulses over this Simla At Home. It was indeed a miserable miser's fraud. But this alarm brings to notice once again the anxiety of people over the food shortage in the country. I am not an expert but I think you will listen to me all the same. Do we as a nation wish to live and make our mark as an independent and civilized people ? I suppose we do. Well then we must sit up and think this food shortage out and do what logically follows. Otherwise we break.

Money can be printed and during short periods of emergency we can use such printed paper to borrow service and labour to meet the emergency, appearing to pay for them. Later we should gradually withdraw the excess money and restore normality. Excess money in circulation does nobody good. It just raises prices. Money is not wealth. It is just a ratio-tool and a credit-token.

We have to pay for what we import from other countries by producing goods in our own country and exporting them in payment of our dues for imports. Our own paper-money is of no use in this connection. What we get from abroad must be paid for fully, if not now, next year or the year after, if we can get our foreign friends to wait that long. If we get machinery for industries or manufactured articles for use or foodgrains to eat, we must pay back either in services rendered or in raw materials or in manufactured articles or in gold or other precious metals. All these have to be exported in such shapes and kinds as are wanted abroad and are acceptable.

Now it is well known India cannot send much out in these ways. Once upon a time we were growing enough food for our people and were also able to produce certain other raw materials or partially prepared stuff for which there was an eager demand in the foreign countries which supplied us the manufactured articles that we imported. We were exporting raw materials so much that we had an account in our favour as net result. We are importing at present a great quantity of manufactured articles from abroad as well as a considerable quantity of foodgrains. For payment we have been depending on our war-time savings banked in England instead of producing extra goods for export. This is good enough for the time being.

But this cannot go on for ever, can it ? We must stop importing to the extent we cannot export. If we do not ourselves stop, it will stop of itself. We must cut our imports down according to what we can now export, and wait for improvement in the latter before we order things from abroad. But whatever we may or may not do, we must eat.

* Speech by His Excellency Shri C. Rajagopalachari broadcast from Delhi Station of All-India Radio on 6 July, 1949.

Anything may wait, but not this. We have to produce all the food we require or we invite famine and chaos which will reduce our population. Nature is a relentless accountant and works automatically.

Government programme to build new dams and reservoirs to bring in new areas under cultivation depend on help from abroad in various ways. This again brings us up against problems of foreign exchange, that is, the problem of payment in goods for the expensive machinery and services that we have to import from abroad. Government try to get these things on credit and are doing their best.

These and other large problems are being tackled by our Government who are doing the utmost they can. Foreign Governments also have not been ungenerous or unhelpful. They are indeed doing all they can to help us because they know India is a great country with plenty of natural resources as well as a very brainy industrious population, and so India is sure one day to be a great and valuable unit in the civilized world. Our brains and our working capacity, which together form the principal element in wealth, are quite good in quantity and quality. Everyone in the world admits this. We cannot however fulfil these high expectations unless we in the meanwhile produce enough food to live and work efficiently. Even if we are unable to do much at once in the way of producing manufactured articles in surplus for export, we ought to grow all the food we require.

We are a rice-eating people. We also consume a large quantity of wheat. We cannot easily and at once expand the area under rice cultivation. The shortage in one kind of food can be made up by another if we know how to adjust ourselves. We cannot afford to sit still until irrigation schemes for increased rice cultivation are completed. We must grow such things as can be immediately grown by way of food, whatever they may be. We can produce more millet and pulses and tubers than we do now. We must raise poultry for eggs and grow fish in our ponds and fruit and vegetables in our house-yards and make up for shortage in calories.

The standard of life among the working classes has gone up. It *must* go up and it is well that it has gone up. The peasants and landless rural labourers who used to eat *ragi*, maize or millets, and ate rice only on festive and rare occasions, now eat rice generally and are not happy unless they get it. Besides the change-over in habit, population has increased. There is thus on the whole a great increase in consumption of rice. This is as it should be. But it is not altogether good. In the first place a pure rice diet is not so good for health as it may be for taste. But apart from this we have as a result gone short of rice. We cannot easily expand the area of rice cultivation, for it requires dams and canals which involve vast expenditure and cannot be got ready quickly. We can however raise more millet and pulses and tubers without large irrigation projects. It is therefore desirable that the fashion must be set for greater consumption of *ragi*, *cholam*, maize and millet. Nothing can be done by way of setting a fashion except by the so-called upper classes. What they do is eagerly copied by others. Like jail-going, hobnobbing with outcastes, spinning, wearing Gandhi-caps, millet-food must be made a patriotic high class fashion. This will lighten the present load on rice.

This great mother, the ground on which we walk and live, is a wonderful mother, most generous, most forgiving and most skilful. Put anything into it, be it the worst rotten stuff, mere offal or what we throw out as excrement, this ever-loving sleepless mother converts it for us by an alchemy of her own into rich food which shoots up, juicy and fragrant. But she requires a little help from us, just a little help and some watchful cooperation. You must know what to sow as seed and when, and look after the shoots that come up. The earth returns with interest what you put in. Receiving offal and excrement, she gives us back pumpkins, cucumbers, bananas, whatever we know how to raise.

Urban authorities should consider it their sacred obligation to collect and conserve town refuse and make good manure out of it and place it at the disposal of gardeners and cultivators of land at a reasonable price. People gather more and more into urban areas and it is the duty of the civic authorities to remember their obligations to the rural areas that feed the towns and return at least in part the nitrogen that flows into the urban areas. This can be done by careful conservation and disposal of the organic refuse of the towns. Apart from animal droppings, what is thrown out by townsfolk is a continuous and considerable drain

on the rural areas unless there is an organized movement of manure from towns to villages.

What is required is increased interest in raising something by way of food wherever you can and whatever it may be. Now, who is to go round and tell people all this and not only tell, but make people do it? Who did it for weaving and spinning? Who did it for Hindu-Muslim unity? Who did it for removing untouchability? Who did it for fighting the drink-evil? Not Government anyway! The people organized themselves under Congress direction. Government did not and would not do it in the days that are past. Now however Government are not against the people. They are with the people. But Government cannot do some things. They cannot do what individuals and organized groups of individuals can alone do. Officials cannot effectively spread themselves over the vast country and even if they could, it would cost so much that it is impossible. An unofficial nation-wide movement alone can do it. Government will help, but self-help and patriotism produce more than official patronage or interference.

I am speaking frankly and as a citizen. During these last sixty years, whenever there was a great national movement needed in India, the Congress undertook it and did it. The Congress in constructive work is not a party. It is the aggregate of disinterested energy that belongs to the whole nation. In its *khadi* work, in its Harijan work and in all its other constructive work in the past, everyone that was ready and willing to help was welcome to join. While Congress took up responsibility, it did not exclude anyone.

Congress can lead a movement for food-growing and save the country from bankruptcy. But it can succeed only if the people cooperate with fanatical zeal in this as they did in other things during the last three decades. It will be a glorious achievement and pave the way for the fulfilment of all our other aspirations.

Original Articles

COLLECTION, ACCLIMATIZATION AND TRANSPORT OF THE FRY AND FINGERLINGS OF THE MILK-FISH, *CHANOS CHANOS* (FORSKAL)

By V. RANGANATHAN and S. V. GANAPATI

THE importance of 'increasing variety with bulk' of the food fishes of Madras has been emphasized by Job and Chacko[1]. The milk-fish, *Chanos chanos*, which is prized as one of the chief coastal food fishes on account of its delicate flavour, not only grows quickly to about 25 in. in a year in freshwater[2], but also its fry and fingerlings are available in abundance from the mud flats in and around Krusadai Island (Gulf of Manaar), in the tidal creeks near Pamban, Ramnad District, in Adyar and Ennore Estuaries, Chingleput District and in the tidal pools near Malpe on the West Coast. They have been collected and transported annually after conditioning and rough acclimatization for stocking cultivable inland waters by the Madras Government Fisheries Department only in very recent years.

Earlier attempts

As far as the authors are aware, there are no published accounts portraying accurately the conditions under which the fry are collected and acclimatized in the field and transported inland, except the following:

(a) The first attempt to transfer 500 fry from the swamp to a large natural pond at Thonithurai was made in 1931-32[3].

V. RANGANATHAN, M.Sc., and S. V. GANAPATI, B.A., M.Sc., A.R.I.C., belong to the Fisheries Department, Government of Madras.

[1] Job, T. J. and Chacko, P. I. (1947). Rearing of Salt-water Fish in Freshwater of Madras, *Indian Ecologist*, Vol. 2, No. 1, pp. 1-9.

[2] Chidambaram, K. and Unnie, K. M. (1946). Variations in the Rate of Growth of the Milk-Fish *Chanos chanos*, *Nature*, 157; No. 3986, p. 375.

[3] Sundar Raj, B. *Administration Report of the Madras Fisheries Department*, 1931-32.

(b) '........Attempts were made in the past to introduce them into the Ippur Fish Farm, but they were not successful as the fry were collected from the neighbouring highly concentrated saline channels in salt creeks, the salinity of which was far higher than that even of the sea and therefore scarcely any survived after their introduction into the pond. An attempt was made during the year under report to rear this fish in the farm and 755 fingerlings were brought from Krusadai Island and introduced into the pond. If, as is expected, the experiment proved a success, it will be extended to other waters'.[4] In the subsequent annual reports of Dr Sundar Raj, the then Director of Fisheries, Madras, no mention is made about the failure or success of the above experiment.

(c) Chidambaram and Unnie[2] have stated that 'the technique of acclimatizing and conditioning milk-fish fingerlings for transporting and stocking in fresh waters has been perfected at Krusadai', but there is nowhere any record describing the technique. Therefore, an attempt has been made in this paper to place on record how during the fry season of 1948, a record collection of about one lakh of fry was made, acclimatized and transported to other fish farms and ponds in the interior with very slight mortality in a few cases only. In several instances, the transported fry were followed and the water was examined for temperature, *p*H, chloride content; condition of the fry and mortality at wayside stations and at their destination several hundreds of miles away from Pamban were also noted. Since acclimatization of the salt water fish seeds to

[4] Sundar Raj, B. *Administration Report of the Madras Fisheries Department*, 1939-40.

fresh water in the shortest possible time and with the least percentage of mortality is of considerable economic importance especially at the present time, our attention was mainly directed to that end in all our field experiments.

Details of 1948 attempt

Preliminary arrangements: Since the *Chanos* fry are known to appear in large numbers from April to August every year, in the tidal creeks near Pamban, the collection grounds were inspected as early as 11 March, 1948 and arrangements were made with a local fisherman for supplying conditioned and acclimatized fry under departmental supervision at the rate of Rs. 10 per 1,000 for delivery in the train at the Pamban junction. Further, a nursery measuring 100 ft.×25 ft.×3 ft. was constructed close to the shore in Pamban for stocking all the collected fry during the course of the day by the contractor. The nursery was connected to the sea during high tide so that fresh sea water was entering it every day, to offset the loss due to evaporation. Another private pond was also requisitioned for stocking and conditioning them in case of necessity.

Commencement of the fry season: The first appearance of the fry was noticed on 2 April and in a few days thereafter the contractor had stocked the nursery with 5,000 fry varying from half to one inch in size. The fry collection season lasted exactly for three months from 4 April to 4 July during which period more than one lakh fry was collected.

Establishment: The Assistant Inspector of Fisheries at Manamadurai (Ramnad District) was placed in charge of the work who was helped by two fieldmen. One of them was deputed to look after the collection of the fry while the other was in charge of the important work of acclimatization and transport.

Fishery equipment: Three conditioning boxes and 163 round tin carriers were used for the purpose. The Assistant Directors of the several divisions in the province were requested to place their indents for the required number of fry and to send their own tin carriers in good condition for ready transport and they readily responded to the request.

Collection of the fry: The flat sandy regions all round the island furnished the largest catch. The fry were seen in vast shoals when they were usually caught by batches of women workers consisting of five workers. Two of the workers waded each batch through ankle deep water carrying the two ends of a *saree* measuring 10 ft.×4 ft., holding it loosely above the water surface. Another pair dragged under water a coir rope about 10 ft. in length with palmyra leaves attached all along its length, just in front of the cloth. The rope was touching the bottom, so that the fry in fright leapt into the cloth behind from which they were removed carefully to a tin carrier carried by a fifth woman, containing sea water. When a tin carrier contained about 500 fry it was taken immediately to the nursery where they were emptied. In this way the contractor was able to collect every day about 5,000 to 10,000 fry.

Till the second week of May 1948 collections were made in the creeks near Chinnapalam; later from a place called Kallingal, a railway bridge over a creek situated between Pamban Railway Station and Rameswaram. From the first week of April to the the first week of May was the peak period of collection. There was a second smaller maxima in the third week of May in the creeks near Kallingal. In this manner over 100,000 fry were stocked in the nursery.

One day unfortunately, a serious depletion of the fry was caused by the entry of predators locally called *keeli*, a cat-fish, into the nursery. Fortunately they were netted and removed in time without much loss.

By the end of June, fingerlings measuring 3 in. to 4 in. were available, and, as their collection was not considered economical, the operation had to be stopped, although fingerlings were available in thousands till the first week of July.

Conditioning and acclimatization

After stocking in the nursery, the fry required for transport on the next day were collected from the nursery in the same manner as described above for collecting them from the mud flats, counted and kept in a condition box in lots of 2,000 in the evening at about 6 p.m. prior to their despatch on the following day.

From the condition box the fry were taken at about 7 a.m. on the next day and kept in tin carriers in lots of 200 or 100 depending upon the size. If the fry were about half to two inches, then 200 could be taken and if over that size, about 100 in each tin. The tins were filled to a third of their height with four buckets

of water amounting to about 1·4 gallons from the nursery to begin with. They were taken next to a cocoanut tope where there is a well containing freshwater, which is used by the people of the locality for drinking purposes.

On reaching the well in the tope, one bucket of water from each tin was removed and was replaced by one bucket of well water. This operation was repeated three times without allowing any definite time interval after each dilution. On the fourth occasion all the water in the tins was replaced by fresh well water and the tins were taken to the Pamban Railway Station where one more bucket of fresh water was added from the well near the station. Finally, just before loading the tins into the railway van, three buckets of water were removed from the tin and were replaced by two buckets of fresh well water. Samples of water were collected from different situations during one such operation on 8 May, 1948 and examined for temperature and chlorinity. The results (Table I) are the averages of three separate tins used for each experiment.

TABLE I

Percentage of reduction of chlorinity and mortality during process of acclimatization

Description	Time	Temperature C.	Dilution in terms of buckets	Chlorinity (parts per 100,000)	Percentage of reduction in chlorinity	Condition of fry	Percentage of mortality
1. Nursery water (A)	7.40 a.m.	29·4	4 A	2620·0	—	Good	*nil*
2. Well water (B) (Cocoanut tope)	8.00 ,,	30·2	—	40·0	—	—	—
3. do. Pamban Railway Station (C)	12.20 p.m.	31·8	—	80·0	—	—	—
4. Total water	(1·4 gallons)		4 A	—	—	—	—
1st dilution	8.45 a.m.	30·2	—1A+1B of second dilution	1975·0	24·7	Good	0·2
2nd ,,	9.50 ,,	30·4	—1+1B of second dilution	1491·0	43·9	,,	*nil*
3rd ,,	10.40 ,,	30·8	—4+4B	40·0	98·5	,,	,,
4th ,,	11.35 ,,	31·0	4+1C	60·0	97·7	,,	,,
5th ,,	12.20 p.m.	31·2	—3+2C	70·0	97·3	,,	,,

It will be seen from Table I that except for a mortality of 0·2 per cent in the first dilution which might have been to due accidents during transfer, there was practically no mortality at all when the percentage of reduction of chlorinity was 98·5 in the third dilution. Secondly, the entire process of acclimatization was over in about five hours during which the fry varying in numbers from 6,000 to 91,000, were acclimatized practically without any mortality. Thus 24 hours were taken for conditioning and about six hours for acclimatization.

In Table II is given the total number of fry acclimatized and transported in the manner described above on the various dates noted against each during the season.

TABLE II

Number of fry of milk-fish Chanos chanos *booked from Pamban Railway Station*

Serial number	Date	Destination	No. of tins	No. of fry	Total
1	12-4-48	Assistant Director (I) (Development), Madras	12	1,600	..
2	,,	Assistant Fishery Demonstrator, Palghat	8	4,400	6,000
3	15-4-48	Chettinad	7	1,200	10,200
4	16-4-48	Assistant Fishery Demonstrator, Palghat	8	3,000	10,200
5	17-4-48	Inspector of Fisheries, Vellore	12	3,000	13,200
6	,,	Assistant Fishery Demonstrator, Palghat	10	4,200	17,400
7	18-4-48	do.	10	3,400	20,800
8	20-4-48	do.	6	1,500	22,300
9	21-4-48	do.	10	3,500	25,800
10	22-4-48	Adirampatnam	4	600	26,000
11	23-4-48	Chettinad	10	5,000	31,400
12	25-4-48	Inspector of Fisheries, Vellore	12	4,400	35,800
13	27-4-48	Assistant Fishery Demonstrator, Palghat	15	5,500	41,300
14	29-4-48	Fishery Demonstrator, Trichinopoly	6		
		Kulitalai	2	2,100	43,400
		Manaparai	1		
15	,,	Palghat	15	7,850	51,250
16	2-5-48	Fishery Demonstrator, Coimbatore	15	5,200	56,450
17	5-5-48	do.	15	1,900	58,350
18	8-5-48	do.	15	3,000	61,350
19	9-5-48	Fishery Demonstrator, Madura	10	2,000	63,350
20	13-5-48	Assistant Inspector, Chidambaram	6	700	64,050
21	14-5-48	Assistant Director (I) (Development), Madras	9	1,100	..
22	,,	do. Fresh Water Research, Madras	5	600	65,750
23	25-5-48	Chettinad	10	2,500	68,250
24	26-5-48	do.	10	6,000	74,250
25	28-5-48	Chidambaram	10	3,250	77,500
26	29-5-48	Assistant Director (I) (Development), Madras	10	3,500	81,000
27	31-5-48	do. Fresh Water Research, Madras	9	2,500	83,500
28	5-6-48	Chingleput	5	3,000	86,500
29	7-6-48	Chidambaram	6	3,000	89,500
30	10-6-48	Inspector of Fisheries, Mettur Dam	9	1,500	91,000
31	11-6-48	Assistant Driector (I) Development, Madras	11	1,000	92,000
32	14-6-48	Chingleput	10	1,300	93,300
33	21-6-48	Assistant Fishery Demonstrator, Palghat	10	700	94,000
34	23-6-48	Assistant Director (I) (Central), Madras	12	600	94,600
35	25-6-48	Assistant Fishery Demonstrator, Chettinad	10	1,000	95,600
36	28-6-48	do.	5	900	96,500
37	1-7-48	Fishery Demonstrator, Madura	10	400	96,900

Two facts will have to be mentioned in connection with the transportation of *Chanos* fry to our fish farms all over the Presidency. Due to a lightning strike by the railway running staff, the demands of all officers could not be met. Further, indents for *Chanos* came pouring in towards the close of the season. So, if in the following year, indents are placed with the Assistant Director, R.F.D., Coimbatore, sufficiently early in the second week of March

along with the tins, it will be possible to collect and transport several lakhs of fry from this source alone.

Mortality in transit and at destination

Mortality of *Chanos* in transit or at destination was recorded in a few cases only and on the basis of these figures (Table III), it may be stated that the maximum percentage of mortality was about 2·5.

TABLE III

Percentage of mortality in transit of Chanos chanos.

Date of booking	No. booked	Destination	No. received	Percentage of mortality
16-4-48	3,000	Palghat	2,980	0·66
21-4-48	3,500	do.	3,416	2·4
29-4-48	2,100	Trichy	2,100	Nil
2-5-48	5,200	Coimbatore	5,100	0·8
9-5-48	2,000	Madura	1,978	

There were a few exceptions when heavy mortality was also recorded due to exceptional causes:

(a) Sixty per cent mortality of a consignment received at Coimbatore was due to the negligence of the Fishery Demonstrator's unit at Madura in not changing the water at the proper time and to the holding up of the tin carriers in a parcel van.

(b) Over 60 per cent of mortality was reported by the Assistant Director, Fresh Water Research, Madras, for want of proper intimation at the destination and to the consequent delay in taking delivery of the consignment.

(c) A third consignment booked to Madura resulted in 75 per cent mortality due to the well water containing H_2S which was used in Pamban for the final dilution. So it is essential that the water used for dilution should be free from H_2S and other poisonous gases or substances.

Examination of fish consignments in transit

On 5 May, 1948, fifteen tins containing 1,900 fry on their way to Coimbatore were examined at about 9 p.m. at Madura Railway Station. The tins were examined in the van. The temperature of water in the tins varied from 30° to 31·2° C. and water samples from two of the tins which were examined gave the following results of analysis.

	Tin A	Tin B
	Parts per 100,000	
Free carbondioxide ...	*nil*	*nil*
Carbonates ...	0·9	0·9
Bicarbonates ...	47·215	49·105
*p*H	8·1	8·0
Dissolved oxygen (c.c.)	0·551	0·206
Chloride	480·0	390·0

It will be seen from the above random sampling that the chloride content of the water in the tins was still high so as to call it brackish and not fresh water even after dilution at Madura. It is therefore considered essential that in future when tins are despatched from Pamban, the chloride content must be estimated by a rough and ready method, to ensure that it will be less than at least 50 parts per 100,000. Steps are being taken for this purpose for adoption in the following years.

Experiments on acclimatization

It is stated elsewhere that the total time usually taken in the routine process of acclimatization was about six hours after conditioning for about 24 hours. Four experiments were carried out in the field to study the results when the whole process of acclimatization from salt to fresh water was done at intervals of three hours, two hours, one hour and immediately in three or four stages of varying dilutions. Three tins each containing 100 fry varying from ½ to 2 in. were used for each of the first three experiments. Each tin contained four buckets of the nursery water (with a chlorinity of 2,620 parts per 100,000 which was equivalent to 1·4 gallons). The well water used for dilution contained 40·0 parts per 100,000 of chlorine.

First experiment: Three tins A, B and C were used in this experiment and the dilutions were effected in the following manner at three hourly intervals.

Tin A: The first change was made by removing one bucket of the nursery water with a chlorinity of 2,620 parts and replacing it by an equivalent amount of fresh well water of 40·0 parts per 100,000 of chlorinity and the dilution amounted to one part of fresh water to three of salt water. The second change was made after an interval of three hours, when two buckets of water were

removed from the tin and were replaced by an equivalent amount of fresh well water and the dilution amounted to two parts of fresh water to two of the diluted salt water of the first change. The third change was made again after an interval of three hours when three buckets of water were removed from the tin and were replaced by three buckets of fresh well water which amounted to three parts of fresh water of one of the diluted salt water of the second change.

The results of this experiment are shown below:

Tin	Ratio	Temperature	Chlorinity: parts per 100,000	Percentage of reduction	Percentage of mortality
	F : S				
A	1 : 3	31·6°C.	1,975	75·39	1·00
	2 : 2	33·0 ,, / 32·0	1,008	41·22	*nil*
	3 : 2	33·0 ,, / 31·4	282	8·55	,,

F= Fresh water S= Salt water

Tin B: In the first change, two buckets of water were removed from the tin and were replaced by an equivalent amount of fresh well water amounting to a ratio of 2 of fresh water to 2 of salt water. The second change was made after an interval of three hours when three buckets of water were removed and were replaced by an equivalent amount of fresh salt water. This dilution was equivalent to a ratio of 3 of fresh water to 1 of the diluted salt water of the first change. In the third change, the entire water in the tin was replaced by fresh well water. The results of this experiment are as shown below:

Tin	Ratio	Temperature	Chlorinity: parts per 100,000	Percentage of reduction	Percentage of mortality
	F : S				
B	2 : 2	31·0 °C.	1,330	50·77	*nil*
	3 : 1	32·2 / 31·6	362·5	13·84	,,
	4 : 0	32·2 / 31·6	40·0	1·53	,,

Tin C: The first change was made by removing three buckets of the nursery water from the tin and replacing it by an equivalent quantity of fresh well water. The resulting dilution worked to a ratio of 3 parts of fresh water to 1 of salt water. After an interval of three hours, the second change was made by replacing the entire water in the tin by fresh well water. The results are given below:

Tin	Ratio	Temperature	Chlorinity: parts per 100,000	Percentage of reduction	Percentage of mortality
	F : S				
C	3 : 1	30·6° C.	685	26·14	*nil*
	4 : 0	31·6 / 31·2	40·0	1·53	,,

Second experiment: This was exactly similar to the first experiment with the important difference that the dilutions were effected after an interval of two hours in each of the three tins D, E and F. The results are recorded below:

Tin	Dilution	Temperature	Chlorinity: parts per 100,000	Percentage of reduction	Percentage of mortality
	F : S				
C	1 : 3	31.8 °C.	1,975	75.39	
	2 : 2	32.1/31.2	1,008	41.22	
	3 : 1	31.8/31.4	282	8.55	*nil*
	4 : 0	32.0	40	1.53	
D	2 : 2	31·2	1,330	50·70	
	3 : 1	31.8/31.3	362·5	13·84	*nil*
	4 : 0	31.6 31.2	40	1.53	
E	3 : 1	31.6/31.2	685	26.14	
	4 : 0	31.4 31.2	40	1.53	*nil*

Third experiment: This was also exactly similar to the first two experiments with the important difference that the dilutions were effected after an interval of one hour. The results of this experiment are recorded below:

Tin	Dilution	Temperature	Chlorinity : parts per 100,000	Percentage of reduction	Percentage of mortality
	F : S				
F	1 : 3	31·6°C.	1975	75·39	*nil*
	2 : 2	31·8/31·4	1008	41·22	,,
	3 : 1	31·8/31·3	282	8·55	,,
	4 : 0	31·2/31·2	40	1·53	,,
G	2 : 2	31·2	1330	50·77	,,
	3 : 1	31·7/31·2	362·5	13·84	,,
	4 : 0	31·2/31·2	40	1·53	,,
H	3 : 1	30 9	685	26·14	,,
	4 : 0	31·4/31·2	40	1·53	,,

Fourth experiment : In this experiment, 17 fingerlings of *Chanos* measuring about 4·2 in. in length were used. The nursery water was completely replaced four times by fresh well water after intervals of ten minutes on each occasion, when there was not even a single mortality. The temperature of the nursery water was 35·0°C. and that of the well water was 31·2°C.

Conclusion

It will be seen from the above that the fry and fingerlings of the milk-fish *Chanos chanos* can be easily acclimatized to freshwater without resorting to the time-consuming process of reducing the salinity in gradual stages. The knowledge that this important salt water fish could withstand even direct transference from salt to fresh water, has a vital bearing on the possibilities of their culture in inland waters.

THE COORDINATED RESEARCH ON THE WASTE PRODUCTS OF COFFEE

IT was known for a long time that the pulpy residue from the coffee bean was a good feed for cattle. It remained a waste product for the simple reason that cattle did not like the taste of it, and therefore would not eat it. At a cooperative experiment station in El Salvador, American and Salvadorean researchers, by experimenting with additional ingredients, evolved a formula that made the material palatable to milch cows. The waste material can now be used as a substitute for corn. If all the coffee pulp in Latin America were converted to cattle feed, a not impossible task, it would provide the equivalent of about 34 million bushels of corn a year. Such an achievement would be significant for both the health and economies of the Latin American countries, which are now producing only a small percentage of the milk their peoples need. (R.S.)

MALT INDUSTRY IN MADRAS

By A. SANKARAM

MANY people are well acquainted with products of the types of Benger's Food, Mellins Food, Horlicks Malted Milk, Grapenuts and Malt Extract. They are foods predigested by a series of chemical and bio-chemical processes in the factory and put up in a form in which they are easily digested and assimilated by infants and people with weak digestive power. They are therefore styled as infant and invalid foods. The basis of all these foods is malt, a product usually prepared from barley, which is not cultivated in South India except on the Nilgiris. The malting of a variety of cereals produced in South India as a substitute for barley with a view to make infant and invalid foods was the object of an investigation started by Mr. B. Viswanath (now Rao Bahadur Dr B. Viswanath, C.I.E., D.Sc., F.R.I.C.) and his colleagues in the chemical laboratory of the Government Agricultural Chemist, Coimbatore. *Sorghum* (Hindi: *Jowar*, Tel: *Jonna*, Tamil: *Cholam*) was found to be the best among the cereals tried closely followed by *ragi* (*Elusine coracana*).

Early history

At the instance of the Indian Munitions Board the investigations on the malting of *Sorghum* were continued in greater detail in the year 1923. An examination of 18 varieties of *Sorghum* with regard to their suitability for malting revealed that the best of them gave almost the same kind of extract as barley. Further the optimum conditions of steeping, couching and drying were studied and a detailed comparison of the action of *Sorghum* and barley malt extracts on starch was made. Studies on the hydrolysis of starch by *Sorghum* malt indicated that certain varieties of *Sorghum* gave practically the same extract as barley used as control, and that there was wide scope for the use of *Sorghum* in the preparation of malt foods.

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Work by the Industries Department

In 1922, the Department of Industries, Madras interested itself in the problem of preparation of malted foods. An Industrial Chemist was appointed to investigate the possibilities of large scale operations with *Sorghum*. The scope of inquiry was limited to (i) the lowering and control of temperature at Coimbatore and (ii) successive production of malts of fairly uniform quality from bag-lots of *Sorghum*. The experiments were conducted on a semi-industrial scale using lots of 1 cwt. of *Sorghum* which could be easily handled by a small factory. The results of the investigations justified the conclusions that it was possible to produce successive lots of malt of uniform quality under Coimbatore conditions and that about the same percentage of extract could be got from *Sorghum* malt as from barley malt. The results of these experiments were embodied in *Bulletin of the Department of Industries and Agriculture*, No. 1, 1925.

Chemical aspects of malt-making

Having thus demonstrated the possibility of manufacturing on a large scale from *Sorghum* grain a malt food, which was suitable for infants and invalids and could effectively replace the huge imports of similar foods from abroad, it was thought desirable to conduct further researches on the chemistry of malt-making. Standardization of the technique of malting to obtain a malt of superior and uniform quality formed the work of prime importance. The results of trials in this direction finally indicated that steeping the grain for 24 hours, couching over a week and kilning at a fairly low temperature of 70°C. for longer periods and the use of polishing machine designed by the Research Engineer, Coimbatore, were essential to achieve the desired results.

Studies on lintner value of malt food

The lintner value of a malt is the measure of the capacity of the enzyme contained in the cereal to convert insoluble starch into soluble sugar, maltose. It is therefore not a measure of the digestibility of the food but only a measure of the power to render the insoluble starch into soluble and an easily assimable sugar. A malt food with high lintner value is therefore valuable in so far as it is potentially a supplier of large quantities of soluble sugars. One way of increasing this value with *Sorghum* is to attempt to prolong the period of couching, i.e. by suppressing the germination by lowering the temperature during couching. *Sorghum* grains after steeping were placed in a cold chamber and samples drawn every other day for analysis of lintner value. It was seen that by prolonging the period of couching under low temperature of 66° F. the lintner value rose from 9·8° L on the fourth day to a value of 20·4° L on the eighth day—this value being the maximum and thereafter the value remained steady or tended to deteriorate. In the case of *ragi* (*Elusine coracana*) the value is always low (6·3 to 8·3° L), lowest in white *ragi* (5·3° L), and does not seem capable of improvement. With wheat high values (40 to 45° L) can be obtained even with much shorter periods of couching than *Sorghum*. This is probably the reason why wheat malts are used extensively in the preparation of malt foods covered by patents. The malt food powder after partial roasting even under controlled conditions of slow roasting in a current of air resulted in considerable fall in the lintner value; a malt of about 20·0° L had a value of about 8·0° L. It is interesting to note, however, that certain well-known proprietary malt foods had even lower values as determined from locally purchased samples as given below:

	Type of food	Diastatic value: degrees L
1	Malted milk type	4·4
2	Malted milk type	2·5
3	Composite malt egg type ...	27·1
4	Composite milk cocoa egg type	47·2
5	Malted milk type	1·9

After the termination of the scheme of work financed by the Indian Council of Agricultural Research in 1938-39, it was continued as a part of the work of the Chemical Section under the direction of the Government Agricultural Chemist. The first step was to follow up the recommendation of Sir John Russel[1] that medical opinion should be sought on the suitability of *Sorghum* malt for infants and invalids by actual clinical tests before it was offered to the public for general use. Accordingly malt food was supplied to 27 hospitals and clinics (Government-owned as well as private) in the province and the opinions obtained therefrom were in general very encouraging in that the malt food was as much relished by invalids and infants as of the foreign products under common use at that time. The clinical reports also indicated that malt food was specially useful in gastro-intestinal disorders.

Large-scale developments of the industry

The Government of Madras was pleased to sanction in the first instance the construction of a pilot plant of capacity of 150 lb. of malt food per month. Encouraged by the results that emerged out of this trial, production of malt food on a commercial scale in a factory rated to produce 36,000 lb. per annum was started. The factory was put in the charge of a business manager and has been in operation from that day.

Malt extract—its preparation

The possibility of making malt extract out of *Sorghum* and *ragi* malts has been the subject of study in the laboratory of the Government Agricultural Chemist for some years past. Originally the making of the extract was confined to the coarse malt meal, cold and hot water extraction, filtration and concentration in vacuo. This process gave a dark coloured viscid liquid with a caramalized flavour which would detract from its value in the market as a substitute for imported malt extracts. By a modification of the technique which consists in filtering through active carbon before concentrating in vacuo, it was possible to get a honey-coloured translucent viscuos liquid extract which was free from caramalized flavour. By fortification of this extract with vitamin A in the shape of high potency shark liver oil, it was possible to obtain a product which compared favourably

[1] Russel, Sir John. *The Work of the I.C.A.R. in Applying Science to Crop Production.*

PLATE 48

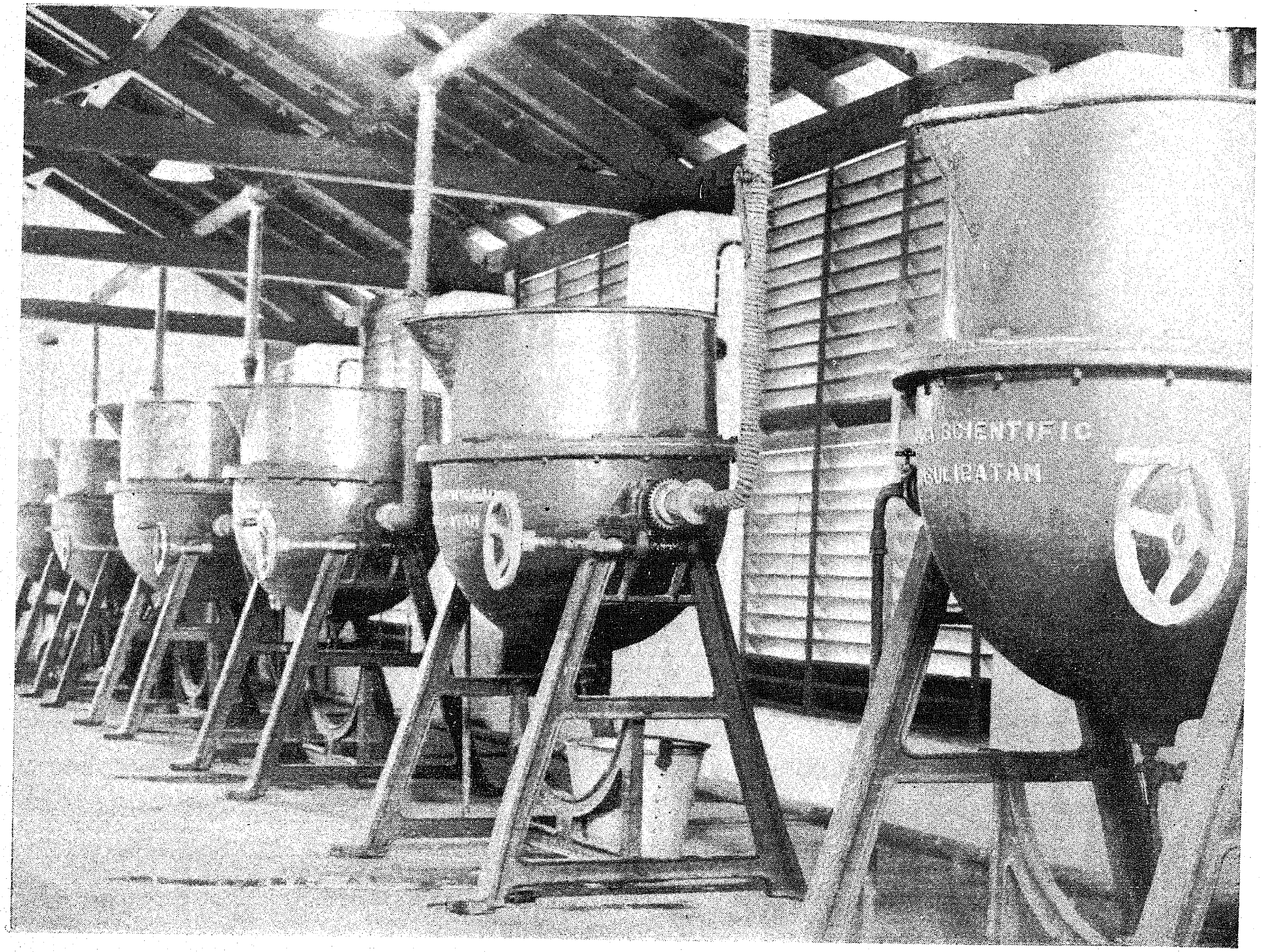

FIG. 1. A battery of macerating vats

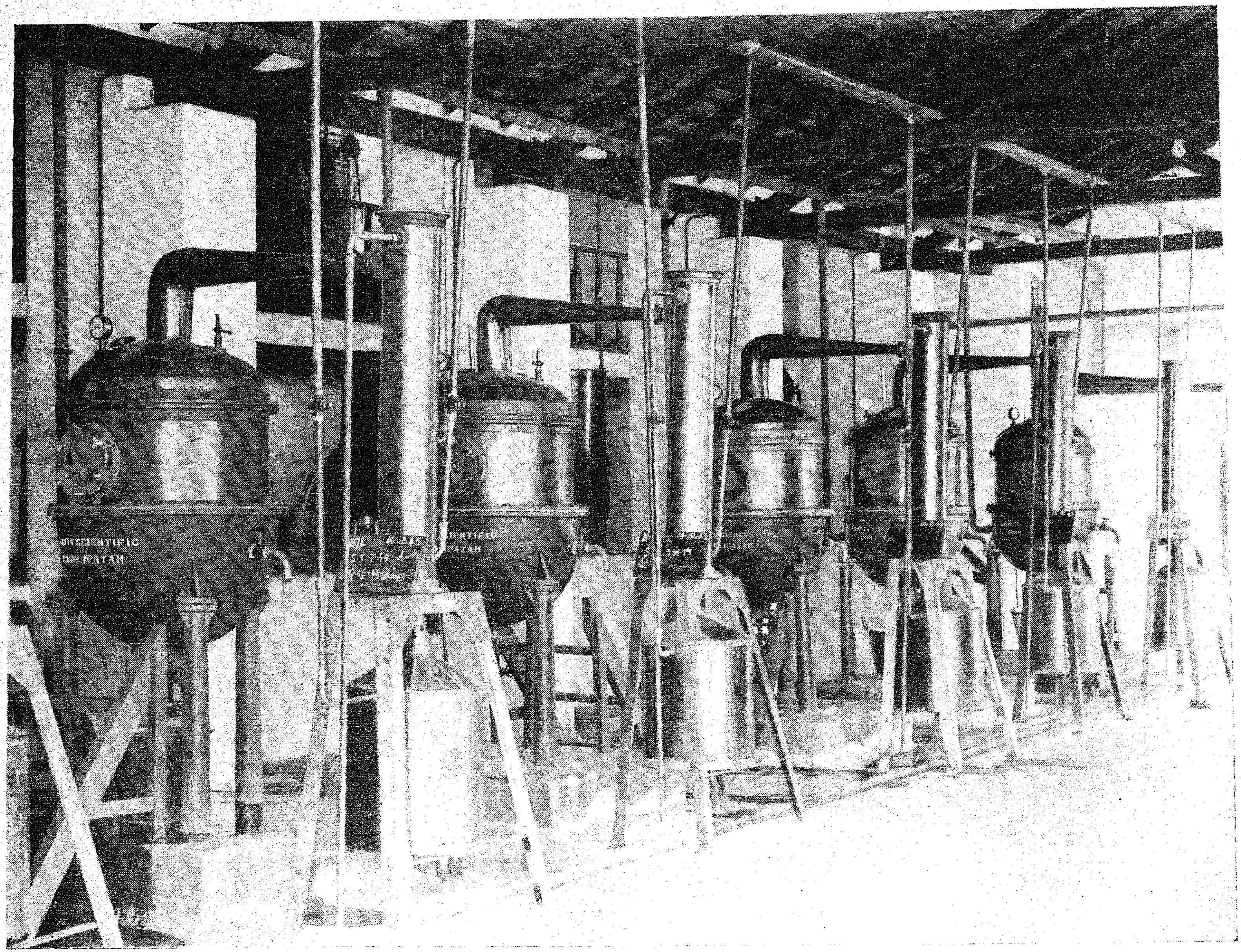

FIG. 2. A battery of vaccum stalls

with imported patent preparations like Kepler's cod liver oil with malt extract. The preparation of malt extract of good quality having proved a success on a laboratory scale, a pilot plant for its preparation on a large-scale was set up in 1942. The working of this plant fully justified the production of the extract and its products on a factory scale similar to that of malt food. The installation of a factory capable of producing 15,000 lb. of malt extract per annum, was sanctioned by the Government in 1942. These units came into operation and malt extract of excellent quality with and without shark liver oil has since then been produced by the factory in large quantities. The production readily answered the needs of the Defence Services during the war and civil demand is being sought for now.

Government Malt Factory, Coimbatore

The Government Malt Factory at Coimbatore consists of two working units, one for the production of malt food and the other for malt extract. *Sorghum* grain is the basic raw material for the said purpose. Under special refrigeration rooms couching or germination of the grain is carried out at temperature of 65°F. for a period of one week to ten days. The grain is then sun-dried and passed through definite stages, i.e. polishing, roasting, grinding and sieving. The coarse meal that does not pass through 100 mesh sieve is known as the coarse malt and is used for the manufacture of malt extract. A yield of 20 to 25 per cent of the malt food is normally obtained from good grain of *Sorghum*. A set of three polishers, six roasters, three grinders, and three sieving machines are set up in the factory which is rated to produce 300 lb. of malt food per day. The food is packed in one pound bottles and sealed in carbondioxide gas.

The malt extract plant has a maximum capacity of 250 lb. of malt extract per day. The equipment consists of a battery of six steam jacketed pans (50 gallons capacity), a set of six centrifuges, six vacuum filters and six vacuum stills (50 gallons capacity). An electrically-driven stirrer is used for the complete fortification of the extract with shark liver oil. The process of preparation of the extract in brief is as follows. Fifty pounds of the green malt and 50 lb. of coarse or roasted malt are mashed in each pan with 40 gallons of water at 60°C. for three to four hours to complete diastatic break down of starch. The supernetant liquid is first drawn off and the thick liquid remaining in the mash tub is centrifuged and the centrifugal liquid is filtered under suction through a bed of active carbon. The clear filtrate obtained therefrom is changed into the vacuum still where it is concentrated at 62° to 65°C. and it takes nearly 16 to 20 hours for the extract to attain the desired consistency. The final extract thus obtained is of a rich honey colour, viscuos and palatable. It has a specific gravity of 1·4 to 1·45 and a refractive index of 1·4950 to 1·500 and contains 70 to 75 per cent of sugar as maltose. This extract known as the plain extract is mixed with high potency shark liver oil to give about 200 I.U. of vitamin A per gm. and is bottled in one pound amber or green coloured bottles. The yield of the extract is usually 25 to 30 per cent.

Popularization of malt food

Side by side with the work of malt-making on a factory scale, work was also in progress on the manufacture of malt from *Sorghum* grain suitable for small-scale production. The method in essence is the same as that used for large-scale production but all the operations are carried out with simple equipment such as buckets, hand sieves, hand roasters and charcoal fire. This cottage industry method has been widely demonstrated and is in use in Chittor District of the province.

Acknowledgments

To Sri P. Venkataramiah, M.A., B.Sc.(Edin.), who as Government Agricultural Chemist and Principal of the Agricultural College, Coimbatore, was personally engaged in research during the developmental stages of investigation on malting and its translation into an industry, I am deeply indebted for the privilege of working under him and wish to express my sincere gratitude for the very kind direction given in the preparation of this paper.

HYBRID BRINJALS GIVE INCREASED YIELDS

By B. P. PAL and H. B. SINGH

IT is common knowledge that when two varieties of a plant are crossed with each other, the hybrid plants are sometimes more vigorous than the parent plants. Experiments conducted at the Indian Agricultural Research Institute, New Delhi, have shown that this vigour, or hybrid vigour as it is called, occurs in the brinjal to a marked degree and is capable of exploitation for commercial purposes. One hybrid in particular to which the name 'Pusa Purple' has been given, has done extremely well under New Delhi conditions. Daskaloff[1] in Germany and Kakizaki[2,3] in Japan investigated the utilization of hybrid vigour in brinjal and observed that the use of hybrid seed was a practical proposition. In India Venkataramani[4] working on brinjals in Madras reported the manifestation of hybrid vigour by certain intervarietal hybrids but no definite recommendations were made regarding its commercial utilization.

Because hybrid vigour is at its maximum in the first generation and rapidly declines in the following generations, the cross has to be repeated each year and, therefore, the seeds produced by the hybrid plants should not be used. There has been an increasing demand for the seeds of 'Pusa Purple'. It has, however, not been possible to meet the whole of this demand for the crossed seed because up to now the seeds have been produced for experimental purposes only. As the technique of crossing for producing hybrid seed is a simple one in the case of the brinjal, it would be easy to produce hybrid seed at Government Farms or even by private individuals. Small quantities of seeds of the parent varieties could be supplied to those interested by the Division of Botany. Since a single 'crossed' fruit will give anything from 500 to 1,000 seeds, sufficient to plant 0·2 to 0·4 acres, a few successful crosses would be enough to meet requirements in most cases.

1. Daskaloff, C. H. (1941). *Plt. Breed. Abst.* 12: No. 1224.
2. Kakizaki, Y. (1930). *J. Heredity* 21: 253-58.
3. Kakizaki (1931). *Genetics* 16: 1-25.
4. Venkataramani, K. S. (1946). *Proc. Indian Acad.* 23: 266-73.

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Description of 'Pusa Purple' and its parent varieties

The hybrid 'Pusa Purple' is a cross between 'Muktakeshi,' a semi-erect variety with purple flowers and deep purple, rather longish fruits in clusters of two to five, and 'Clustered White', a low-growing variety with white flowers, white medium-long fruits, broader in the middle, borne in clusters of three to six. The latter is an earlier fruiting variety than 'Muktakeshi'. 'Pusa Purple' is conspicuously vigorous resembling 'Muktakeshi' in general habit; the flowers and fruits are purple though intermediate in intensity of colour (Fig. 1). The fruits are long and even when harvested after they have grown to a big size, they are found to contain only immature seeds inside at this stage; consequently they are free from seediness—a defect rather common in brinjals. The hybrid plants begin to bear fruits about 75 to 85 days after sowing, and are earlier than the parent varieties. Under Delhi conditions the frosts damage the crop sometimes at the end of December or the beginning of January when the hybrid plants are still giving quite good yields. If there is no frost the plants will continue to yield for about four months after which they can be pruned to give a second crop later on.

To find out the actual increase in yield when grown on a field scale, the hybrid plants were grown along with those of the two parent varieties in randomized blocks, giving a spacing of three feet between the plants each way. The two reciprocal hybrids 'Muktakeshi'× 'Clustered White' and 'Clustered White'× 'Muktakeshi' yielded 21,382·5 and 22,500 lb. per acre respectively whereas the parent varieties 'Muktakeshi' and 'Clustered White' yielded 15,249 and 13,474·5 lb. respectively. The hybrids thus showed 48·8 and 56·6 per cent increase over the higher parent. The crop was raised under average conditions. With better care, such as is usually bestowed on vegetable crops, much better yield can be obtained.

FIG. 1. A plant of Pusa Purple showing fruits. The branches have been raised to show profuse bearing of fruits

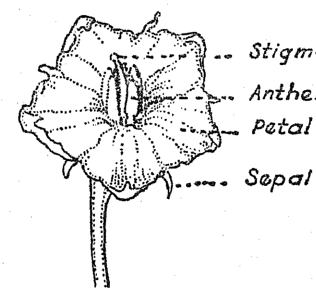

FIG. 2. A fully opened flower showing the various floral parts

FIG. 4. Bagging of the emasculated and pollinated flower

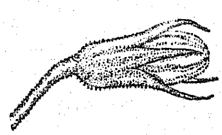

FIG. 3. A bud at the proper stage for emasculation

FIG. 5. Removal of anthers (emasculation)

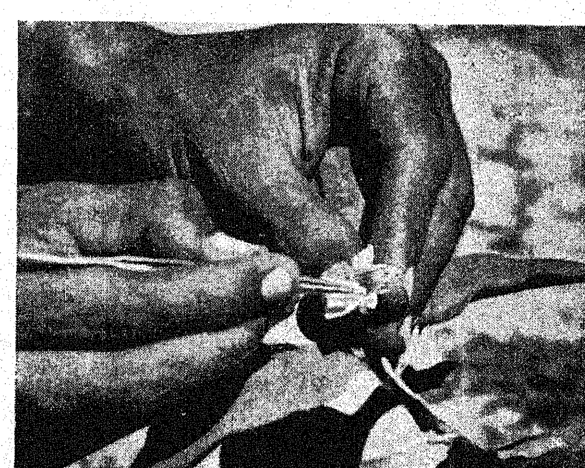

FIG. 6. Pollination ; the pollen is being applied to the stigmatic surface

Trials outside Delhi

To gain further information regarding the performance of this hybrid under different soils and climatic conditions, seeds were supplied to several Provincial Departments of Agriculture and to individual scientists and others residing in different parts of the country. The reports on its performance have been generally favourable, especially those from Almora, Banaras, Allahabad, Koilpatti (Madras), Calcutta, Pusa, Sabour and Lahore. At Almora a solitary plant which was kept through the winter yielded 300 fruits. From Allahabad the Superintendent of the Government Gardens wrote, 'the brinjals are of very superior quality and make very delicious vegetable. The variety is a heavy yielder and its cultivation should be extended as it would be a profitable variety. It gave a calculated yield of 504 maunds 9 seers per acre'. The Secretary, Royal Agri-Horticultural Society of India wrote from Calcutta, 'The brinjal seeds which you very kindly sent me last year have turned out to be an excellent type and I am anxious to let the members of the Society enjoy this type...........'

Nursery raising and planting in the field

The following directions apply to Delhi Province only, and in other areas the necessary adjustment for local conditions should be made. The seeds may be sown in the nursery from the beginning to the middle of July in finely prepared, raised or well-drained flat beds. About 100 seeds should be sown to each square foot of area, $\frac{1}{4}$ to $\frac{1}{2}$ inch deep. It is advantageous to keep the surface of the seed bed covered with a gunny-bag till the germination has commenced. Light hand watering should be done once a day. About 90 to 100 per cent germination may be expected in this way. The young seedlings should be protected from excessive rains. The seedlings will be ready for transplanting in about 20 to 30 days.

As the plants of this hybrid are of semi-erect habit, the seedlings may be planted $3\frac{1}{2}$ ft. apart each way in rich soils, the distance being reduced to $2\frac{1}{2}$ ft. or even less in the case of moderate or poor soils. The field should be irrigated soon after transplanting if there is no rain, or hand watering may be done once or twice a day, depending on the weather, till such time as flooding of the field is possible. After the seedlings have established the crop may be irrigated once a week till winter sets in. During winter months fortnightly irrigations will give optimum results.

In the nursery the seedlings are liable to be attacked by caterpillars and *Epilachna* beetles and in the field by caterpillars and shoot borers. To control ravages handpicking of the insects and removal of the shoots at the points where they have been bored should be done.

Crossing technique

The following hints on crossing may be found useful by those wishing to raise their own crossed seeds.

In the variety to be used as mother parent, the buds due to open the following morning have to be selected the previous evening for emasculation (removal of the stamens or male parts). Such buds usually have their corolla tube reaching the tip of the calyx lobes (Fig. 3). For emasculation the anthers are removed with the help of forceps by opening the corolla tube from one side (Fig. 5). The bud is then covered with a muslin bag measuring about 9 in.×5 in., the size of the bag depending on the size of the fruit of the mother parent (Fig. 4). Next morning the pollen (yellowish powder constituting the male element) from freshly opened flowers of the other parent is taken out by inserting the pointed ends of a pair of forceps into the anthers or pollen-sacs. The pollen is gently applied to the stigma of the emasculated flower (Fig. 6) and bagged again. Various parts of the brinjal flower are shown in Fig. 2. Experience has shown that it is not necessary to bag the flowers of the male parent as the pollen has to be taken out from inside the antherlobes. The bag should be kept on the developing fruit till it has grown sufficiently big because otherwise it is liable to be attacked by fruit borers. The seeds should be extracted soon after the detachment of the ripe fruit from the plant as it becomes difficult to separate the seeds from the dried pulp of the fruit.

Acknowledgment

We are thankful to the Directors of Agriculture, United Provinces, Bihar, Bombay, Bengal and Madras for kindly arranging the trials of 'Pusa Purple' at various stations in their respective provinces. We are also indebted

to the following for testing this hybrid brinjal: Mr. Boshi Sen (Almora), the late Dr V. K. Badami (Banaras), the late Dr H. Chaudhuri (Lahore), Dr K. D. Bagchee (Dehra Dun), Mr. S. Percy Lancaster (Calcutta), Dr F. R. Bharucha (Bombay), Prof. P. Parija (Cuttack) and officials of the Government of India residing in New Delhi.

CONSERVATISM IN FOOD

NUTRITIONAL standards can be calculated with some precision, but appetite remains incalculable, a matter of individual habit. That explains the extreme conservatism of people all over the world in changing their diets. The British people during World War II disciplined themselves to preserve their political freedom at all costs. They, therefore, accepted with good grace, changes in their diets, but not at times without a good deal of scepticism. To effect an economy in shipping space, home-grown rye, oats and barley were added in the form of flour to the bread mixture. Dried skim milk was added for the sake of its nutritive value, and calcium in the form of chalk, to make good the deficiency of that mineral in the national diet. As in India, the British Food Ministry's advance announcement of this last expedient had an amusing sequel. Before the intention to add chalk was actually carried out, people started complaining that the bread tasted nasty !

It is obvious that people who feel that their personal convenience may be threatened by the new experiment in food, will naturally be reluctant to approve it. Their reluctance will be translated into cogent arguments against it. The arguments must be given full weight. Not all will be due to personal interest or prejudice. But in meeting such arguments, the paramount consideration must not be forgotton, that we are fighting a war for economic freedom. India struggling to preserve its economic entity needs every ounce of grain it can save. In the recent words of the Prime Minister: "The food problem is ultimately the totality of what happens in millions of homes. It is a small thing for each one of us to change his food habits slightly and eat substitutes for cereals to some extent. Every country has done so under stress of war and emergency. Are we so tied down to habit that we cannot do something that the good of the nation requires ?"—(*P.I.B.*)

TRENDS OF CATTLE POPULATION IN INDIA

By H. K. LALL

RECENTLY, increased attention has been paid to the cattle census figures, because it is essentially on the basis of these that the amount of milk produced in the country, the number of working animals, and their fodder requirement can be known, and targets set up to achieve the country's requirements in respect of cattle and cattle products. Excessive slaughter during the war gave an impetus to the general feeling that the country was being denuded of the cattle population, particularly the good cattle, thus resulting in an increase in the number of useless ones. To assess the degree of increase or decrease and also to determine, if possible, the factors affecting cattle population, the cattle population of various Indian provinces and States has been studied.

Natural trend in India

There are natural and artificial checks to the growth of population; natural checks are in the form of war, which usually means greater slaughter of animals for meat, famine, diseases and floods. The artificial checks are mechanized farming, which acts by elimination of bullocks, castration, and artificial insemination. The latter checks the increase in population by eliminating indiscriminate breeding. In India, so far no artificial checks have come into force, except, castration of scrub bulls, the number of which has been relatively small, with the result that indiscriminate breeding has been going on, though little less extensively. Artificial insemination and mechanized farming have hardly started and thus the trends of population in this country can be studied under almost natural conditions.

India and other countries

A comparison has also been made of the cattle population in India, with those of Australia, Denmark, the U.S.S.R., Canada, Netherlands, New Zealand, and the U.S.A. having systems of animal husbandry and dairying different from that prevailing in India.

It has been observed that population has increased since 1920, in various countries except in the U.S.S.R., and in India. The population in India steadily increased from 1920 and reached its peak in 1935 which was followed by a decline noticeable in the 1940 and 1945 censuses. In 1945 it went down to the 1930 level, but the rate of decline was the same as in 1940 and 1935. The population has considerably increased in the U.S.A. while it has increased slightly and steadily in the U.K., Denmark, Netherlands, New Zealand, Australia, in spite of the War and wartime shortages. The U.S.S.R. has shown a decline all along since 1920, except for a small rise in 1935-40. In case of the U.S.S.R. the great reduction in 1925 was the result of mass slaughter carried out by the farmers for resisting State control and collectivization of farming. There was some recovery in 1935, but then again the number possibly went down as a result of mechanization. The population in New Zealand, Australia, Denmark, and Netherlands, has increased because these are the countries, whose prosperity mainly depends on the export of livestock products. In the U. K., efforts have always been directed towards self-sufficiency; as fresh milk cannot be easily imported, people sought to increase the number of dairy cattle.

Cows and buffaloes

Since the buffalo in this country competes with the cow for food because of its milk producing qualities, and is likely to effect the cow population, figures for the buffaloes and cows in different provinces and States, for which census figures were available, were analyzed separately from 1920-45, i.e. for quarter of a century.

Cows: The analysis went to show that there was an increase in the cow population in Madras, Punjab, the Central Provinces and Berar, the N.W.F.P. and Coorg, in 1945 as compared to

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1940 and a decrease in Bombay, Sind, Bengal, the United Provinces, Orissa, Assam, Bihar and Hyderabad, the only State for which complete data were available. The population in the provinces did not follow the same trend in the quinquennial years. In all provinces, except for Bengal, the Central Provinces and Berar, the N.W.F.P. and Coorg, the peak was reached in 1935. Significant increase from 1920 level was attained only in the case of the Central Provinces and Berar where the maximum peak was reached in 1930, five years earlier than in the other provinces mentioned above. In Bengal after 1925, there has been a gradual but a constant decline; in the N.W.F.P. the population showing an obvious decline from 1920 onwards, exhibited a sudden spurt in 1940, which was maintained in 1945. The degree of fluctuation was much more in the case of Ajmer-Merwara and Delhi as compared to other provinces, thus showing that the fluctuations in population were more visible in smaller areas than in bigger areas, where perhaps a deficit in one part was covered by an increase in another.

Buffaloes: There has been a general increase in the number of buffaloes in all the provinces, except for some decline noted in Madras, Hyderabad, Ajmer-Merwara, and Delhi in 1940. In Bengal there was a slight decline from 1935 onwards, while in the Central Provinces there was a drop in 1935 and 1940. In 1945, there was a decline in Bombay and Sind, the United Provinces, Assam, Coorg, Bihar and Orissa, while the decline in 1940 in Delhi, Ajmer-Merwara, Madras and Central Provinces was made up by the increase in 1945. The Punjab has shown steady increase all along except for a slight decrease in 1945 as compared to 1940, but there has been an increase of 5·17 crores (18 per cent) over the 1920 population. This has more than offset the slight decrease in the cow population. This general increase in the buffalo population is in conformation with the belief that the buffalo has begun to replace the cow.

The analysis of figures of bullocks, youngstock, cows in milk and useless cattle indicates that there has been a general increase in the number of milking cattle except in Assam, Bombay, Coorg and Bengal. The number of young stock has increased except in Assam, Bombay, Coorg, Madras and Bengal. This decrease in the latter provinces is bound to reflect on the total adult population in the next census, because the adult population essentially depends on the number of youngstock that are born and survive. The number of working animals has decreased in Madras, Bombay, the Central Provinces and Berar and Coorg and Ajmer-Merwara, and has increased in Assam, Delhi, the N.W.F.P., the Punjab, Sind and the United Provinces. There is an insignificant increase in Bengal, while no figures are available for Bihar and Orissa.

Factors affecting cattle population

War influences: The excessive slaughter during the war has been ascribed to be the cause for reduction in the number of cattle. It has, however, been observed that the number of animals slaughtered in city slaughter-houses during the war years did not show any abnormal increase, though there was considerable increase in the number in Army abattoirs; but this number formed an insignificant percentage of the total population and could hardly be considered to have any material effect on the general strength of the population. The population in fact increased in the provinces where no restrictions on slaughter were imposed. Nevertheless the heavy drain on cattle on account of slaughter in the provinces of Bihar, Bengal and Orissa, where large number of troops were stationed, and the export from the United Provinces to the Eastern Provinces cannot be denied. The shortage was also felt because of the ban on the export of cattle from the Punjab, which in peace time supplied large number of cattle to these provinces. The rise in the cost of fodder and concentrates during the war and greater strain on the bullock due to lack of mechanical transport had an adverse affect on the stamina of the livestock in general. No doubt, this effect was counteracted to some extent by the rise of prices of livestock and milk. The effect of war therefore cannot be determined by merely taking the numbers into account; as a matter of fact the decline had already set in in 1935, before the war could have its effect felt on the cattle population of the country.

Diseases: The study of the mortality figures from the year 1930 to 1940, did not indicate any correlation between the growth of cattle population and mortality; for instance, Bengal, Orissa and Bihar showed a decrease in

population in spite of low mortality rate, while there was an increase in the Central Provinces and Berar, having a higher mortality rate. This was very likely on account of the very inefficient system of reporting diseases in the country.

Fodder and grazing: A comparison of fodder and grazing available in the different provinces with the rate of increase or decrease in population in the present state of information does not help to establish any correlation between the two. It is however well known that area under fodder and grazing has not increased in proportion to the increase in population. In other words there is a state of over-population of cattle in spite of the recent reductions.

The population of cows in the canal colonies in the Punjab decreased while that of buffaloes increased because the enhanced prosperity on account of introduction of cash crops enabled people to consume more milk and *ghee*. Keeping this fact in view a comparative study was undertaken on the growth of cattle population and the increase in areas under various cash crops such as sugarcane, cotton, jute, and tobacco, in provinces where these are of importance, but no direct effect of the increase in area under cash crops on the population could be established. The fluctuations in the prices of hides and the number exported did not seem to have affected the growth of population in any appreciable manner.

Rainfall: Rainfall figures for the last 25 years for each province do not contribute towards establishing any relationship between the rainfall in a province and the growth of its cattle population, though it is well known that drought years are bad for the cattle population due to lack of grazing. In order to see the effects of rainfall as well as of the increase in area under cash crops on cattle population, a study seems necessary in small areas where their effects are likely to be more pronounced.

Availability of bulls: The number of bulls in the Punjab, and the United Provinces was small as compared to that in Bengal and Assam, which would mean greater fertility and of course uncontrolled breeding in the latter provinces. But in spite of this the population has been on the decline in Bengal since 1920. This perhaps could be explained by the fact that uncontrolled breeding there, combined with food shortage and malnutrition over a number of years, had an adverse effect on the breeding capacity of the cattle.

Famine and floods: These would affect the population in the area of occurrence. The Hissar famine of 1939 reduced the population of the district by one-half; possibly the reduction of cattle population in the Punjab by four lakhs in 1940 was due to this. No details of mortality due to Bengal famine are available, but the resulting malnutrition caused by it, is likely to have lasting effect, which may be more visible in later years.

Human population: Human population has increased and cattle population has decreased. As most of the cultivable area has to be devoted to food crops there is a reduction in the area used for grazing and fodder. Only when plenty of undeveloped land is available can the cattle population increase in proportion to the increase in human population, but when sufficient land is not available for a large population, the human population has to depend on a smaller number of efficient cattle rather than a large number of inefficient ones, and of course the systems of feeding have to be altered.

Export: It is a well-recognized fact that the export of cattle gives impetus to cattle breeding and that is why the south-eastern Punjab and Delhi, which export cows to Orissa and Bihar and buffaloes to Bombay, have a well-developed cattle industry. The exact data of inter-provincial export from time to time is not available and therefore its effect on the decrease or increase in general population cannot be gauged. The export of cattle outside the country is small and therefore its effect on cattle are primarily observed in the breeding tracts from where the animals are supplied.

Milk prices: The rise in the price of the milk during the war counteracted to some extent the depressing effect of the high prices of fodder and concentrates; not enough data, however, is available to establish the effect of variation in milk prices on the number of cattle.

Conclusion

It may be stated that in the Indian provinces, cow population in 1945 was less by 6 lakhs and 36 lakhs as compared to the 1920 and 1940 figures respectively. The 1945 buffalo population increased by 18 per cent as compared

to that in 1920, though it was slightly less in comparison to the figure in 1940. The cow and buffalo population went on increasing up to 1935, after which a decline set in, in the case of cows, though the buffalo population maintained, more or less, steady increase. Apparently, this goes to show that the conditions after 1935 were perhaps more favourable for the existence of the buffalo than for the cow. This was perhaps due to the fact that all the area available in the country began to be utilized for growing food crops for the increase human population. The result was a decrease in the area for grazing and fodder production. This, as one would expect, affect the cow more than the buffalo which, as is well known, gets preferential treatment on account of its higher productivity.

HORMONE SPRAYS INCREASE PEAR HARVEST

RECORDS kept by the New South Wales Department of Agriculture, Australia, concerning numbers and percentages of fruits dropped from trees before harvesting indicate that spraying with the hormone preparation 2 : 4 D, minimizes pre-harvest drop in William pears.

Following trials in the previous year, sprays containing 2 : 4 D at the rate of seven parts per million were applied to plots of William pear trees from late November, 1949, (the early part of the Australian summer), at intervals until a few weeks before the harvest period.

Records of the numbers and percentages of fruits dropped from the trees before harvesting confirmed that 2 : 4 D was highly effective in minimizing pre-harvest drop in pears of this variety.

In one instance, it was found that only one spraying of 2 : 4 D applied in November kept fruit drop in control. Further tests with single spraying will be made next season.—*Australian Agricultural Newsletter*, No. AGN/249.

BIRD FRIENDS AND FOES OF THE CULTIVATOR

By SALIM ALI

NOT so very long ago the agriculturists of Hungary, having branded the sparrow as an enemy of their crops, doomed it to destruction. Within five years the country was so overrun by insect pests that the sparrow had to be reintroduced. It proved the country's salvation by making short work of the devastating hordes.

A succession of alarmingly poor harvests in France caused the Minister of Agriculture, in 1861, to appoint a scientific commission to investigate the causes. It reported that the deficiency was due to the wholesale slaughter of birds, in the absence of which insect pests had multiplied unchecked.

The staunchest allies

These are just two examples out of many, and must serve as the writing on the wall to all who would have the welfare of the Indian cultivator and the agricultural prosperity of this country at heart. Owing to our innate tardiness in the adoption of progressive scientific techniques, we in India are today perhaps more completely dependent upon the good offices of friendly birds than in many of the more advanced countries. Birds are our staunchest allies here in the ceaseless warfare against crop pests, and it is indeed our misfortune that for want of proper enlightenment we do not realize this fact sufficiently, nor appreciate the magnitude of their beneficent services. Among the birds that normally visit or live about his fields, the cultivator has some very useful friends as he also has destructive enemies. He does not usually know to discriminate between them, and he quite naturally feels he cannot afford to take chances. Therefore he looks upon every bird visitor to his fields as an unwelcome intruder and does his best to scare it away if no more drastic remedy is at hand. And it is not the poor unlettered cultivator alone who suffers from this mentality. The ignorance displayed by people who should know better—even those who have had the advantage of a proper agricultural training—is often equally deplorable.

SALIM ALI is a well known authority on Indian birds and has long been connected with the Bombay Natural History Society.

The fact is that in India the powers that be have never viewed the question of the economic importance of birds with the sympathy or seriousness it deserves. Great strides have been made within recent years in many European countries and in the U.S.A. in research to determine the economic status of birds in general, as well as their value to agric ture, forestry, horticulture and other branches of human industry. Permanent organizations are set up and maintained at considerable State expense for conducting research, both in the field and laboratory, on the food and life-histories of native birds. Very impressive and far-reaching results have been obtained, and in a number of cases the benefits accruing to the agriculturist from a proper scientific control of birds based on such data have been clearly demonstrated by the saving of large sums of private and public money and by substantial additions to the national income.

Need for economic ornithology

It took a long time before economic entomology came into its own in this country. Its achievements and benefactions to agriculture during recent years do not need to be stressed here. The biological control of insect pests is now an accepted technique. Economic ornithology is nowhere in the picture as yet, but it is a subject that should not escape the planners of our destiny in the greater and more prosperous India to be; and the sooner a beginning can be made, the better for the cultivator.

Actually the work that has so far been accomplished in India on the status of birds in our agricultural economy is microscopic and negligible when viewed in the perspective of the vastness of the country, the richness of its bird-life, and the predominating position that agriculture occupies in its economic structure. But even the little that

was done at Pusa some 30 years ago, and at Lyallpur more recently, on the food of certain birds in cultivated tracts—though admittedly piecemeal and haphazard since it fails to take count of the *complete* life-cycles of the birds—should have sufficed to convince the most sceptical well-wisher of the tremendous scope and importance of the subject.

Before it can be decided whether a bird is the cultivator's friend or foe—in other words, whether the bird is beneficial to agriculture or harmful, or neutral—it is essential that we first make a thorough study of its food and feeding habits during its entire life-cycle and not merely during one phase of it (e.g. as adult) or during a particular period when it happens to be unusually plentiful, or when its activities jump into prominence (e.g. as when some particular crop is ripening). Take a common example. A normal brood of the House Sparrow consists of three or four young. They are born helpless, and it is usually something like 12 days before they are grown enough to leave the nest and more or less to feed for themselves. During the whole of the nestling period they have to be fed assiduously by the parents. Young birds have voracious appetites: during the first few days of their life some species consume more than their own weight of food in 24 hours. The food of nestling sparrows consists of moths, caterpillars and other soft-bodied insects. Many of these are notoriously destructive crop pests, and some of the caterpillars may, in turn, devour as much as twice their own weight in leaves per day. One pair of House Sparrows have been observed to bring food to their nest-young between 220 and 260 times per day. Many of the beakfuls held not one but several insects at a time. Multiply this by 12 and you have some idea of the beneficial destruction caused by a single pair of sparrows during this short period, and particularly if the phenomenal prolificness of the insects is also taken into account.

Now, after subsisting entirely on insects so far, our brood of sparrows launches out into the world. Thereafter they betake themselves increasingly to the normal diet of their parents—predominantly grain and seeds of various kinds. As long as this food is gleaned from threshing floors or stubble fields, where it lies more or less as waste material, no great harm is done. But at certain seasons House Sparrows band themselves into enormous flocks and raid ripening *bajri* and other crops doing considerable damage. In addition to this, sparrows are at all times partial to flower and fruit buds and often destroy these on an extensive scale. They likewise make a nuisance of themselves in the vegetable plot. Now, are we to classify the House Sparrow as friend or foe? Are we to take steps to encourage the sparrow to increase and multiply, or are we to keep a strict check up on its numbers, or even exterminate it? This is where the difficulty comes in. But let us be reminded of the story at the commencement of this article; let the sparrow have the benefit of the doubt until such time as we have more precise quantitative and qualitative data concerning its activities.

This, in short, is the unsatisfactory position today. We do not really know for certain who our friends are and who our foes! In an empirical sort of way of course we can roughly gauge which among our birds are beneficial at given periods and in particular areas, and which are harmful. But that is not good enough. We know far too little about the all round status of the various species to justify launching any wholesale measures either for or against them, especially measures of a drastic character.

This then is the function of economic ornithology research: to study complete life-histories of birds in relation to human interests in an attempt to strike an accurate balance sheet of their activities. We have the working models of more advanced countries to guide us. The scheme may involve a considerable outlay and expenditure of public funds. But scientific research should not be judged purely in terms of financial gain.

Determining bird friends and foes

From the fragmentary information that is available at the moment, I would suggest the following alignment of the cultivator's friends and foes, selecting only a few each of the commonest species, and only such whose status appears to me to be more or less beyond doubt. Most of the insect-eating birds found in the neighbourhood of cultivation would probably fall in the category of the ryot's friends since the majority of the insects they devour in his fields are injurious. But there

are many others on the borderline, such as the myna and the Rosy Pastor (Hindustani: *wyha*), beneficial at one season or in one phase of their life-cycle, harmful at another—whose status, like the House Sparrow's, can only be determined by a more critical investigation.

Friends	*Foes*
Black Drongo or King-crow	Jungle crow
Indian Roller or Blue Jay	House crow
Owl	Parakeets

I keep this list purposely small, but it includes the birds that are most usually met with about cultivation everywhere on the Indian plains in variable numbers, and are often quite abundant locally. The beneficial status of the bird friends is tolerably certain, and in the case of the foes I feel that there is sufficient evidence to proceed against them, even drastically in areas where they are menace.

Most poeple should have no difficulty in identifying the birds on the above lists: The Black Drongo or King-crow (Hindustani: *kolsa*, *buchanga* or *kalkilichi*) is of the size of the *bulbul*, uniformly glossy jet black with a long deeply cleft or forked tail. It is met with commonly about cultivation perched rather upright on stakes and telegraph wires. From these look-out posts it darts to the ground now and again to snatch up an unwary insect whose movement has betrayed it. Or it launches into the air to chase a flying locust or moth which is deftly captured on the wing. The birds may also be seen riding on the backs of grazing cattle, swooping on the grasshoppers and other insects disturbed by the animals' progress through the grass.

The Roller or Blue Jay (Hindustani: *nilkant* or *sabzak*) is a prominent and well-known species on account of the brilliant blues in its plumage which flashes in the sun as the bird flies deliberately from one look-out post to another. It keeps vigil singly on telegraph poles and the like near cultivation, and pounces upon large crawling insects like locusts. These it sometimes carries back to a perch and batters to pulp before swallowing. Although protected by law, the Roller is largely persecuted for the sake of its resplendent feathers which have some local demand and also fetch high prices if smuggled out of the country.

All owls, and most of the diurnal birds of prey, hawks, etc. are highly beneficial to agriculture in that they destroy enormous numbers of destructive rodents like field rats and mice, and help to maintain a constant check on the increase of these prolific vermin. All these birds deserve to be encouraged and conserved and not destroyed at sight as is now often the case. Our two commonest owls are the Spotted Owlet and the Great Horned Owl. The Spotted Owlet (Hindustani: *khakusat* or *chogad*) is of the size of the myna, but squat and short-tailed, with a large round head and staring, inquisitive, yellow forwardly directed eyes. In colour it is greyish-brown, spotted with white. It hides in the hollows of ancient trees during daytime and comes out to hunt at evening dusk. But it may sometimes also be seen on the move, and even hunting, in broad daylight. Its food consists of grasshoppers, crickets and other insects as well as lizards and mice. The Great Horned Owl (Hindustani: *ghughu*) is a large yellowish-brown bird of the size of the kite, with tufts of feathers standing out like horns from its head. It spends the daylight hours on ledges and recesses of earth, banks and ravines, or in large leafy trees, feeding at night chiefly on field rats, of which it takes a heavy and regular toll.

The two crows (Hindustani: *kawwa*) need no introduction. The jungle crow is the larger, and uniformly glistening jet black. In forest tracts and rural areas it more or less replaces the House crow (with grey neck) which is found about human habitations. Both species are destructive to *jowar*, *bajra* and other cereal crops, and barring a certain amount of scavenging that they do in towns, they possess no compensating virtues that could be called indispensable.

Parakeets (Hindustani: *tota*) of which there are several species in India—the commonest two being the Rose-ringed and the Blossom-headed—are birds of chiefly green plumage. They go about in noisy flocks, often very large ones, and are undoubtedly amongst the most destructive avian pests in India to cereal crops and fruit of all kinds. They seem to have no redeeming virtues whatsoever from the cultivator's or any other economic point of view, and their numbers deserve to be kept under the strictest check.

HYBRID CORN FOR INDIA

By BOSHI SEN

NOWADAYS it is possible to make plants to order, and hybrid corn is one of these new products. In 1947-48, a little over $7\frac{3}{4}$ million acres were under cultivation of corn (maize) in India. Our estimated total yield was a little over two million tons, 20 per cent short of the demand, and over four lakh tons had to be imported from abroad. Our average yield in 1947 was 8 maunds per acre, which is $1\frac{1}{2}$ *maunds lower* than the average yield per acre obtained during 1936-40. In the United States of America, during the corresponding period, the average yield per acre was *raised* from 16 maunds (1930-34) to 25·3 maunds in 1946. This increase was achieved by the use of hybrid corn seeds. In 1933, hybrid corn seeds were sown in only one acre out of a thousand, but by 1945, 675 acres out of a thousand were planted with hybrid corn. In that year, the increase of yield of corn in the United States of America was over 17 million tons. Translated into increased income to the farmers, this meant 700 million dollars.

Hybrid corn—a modern miracle

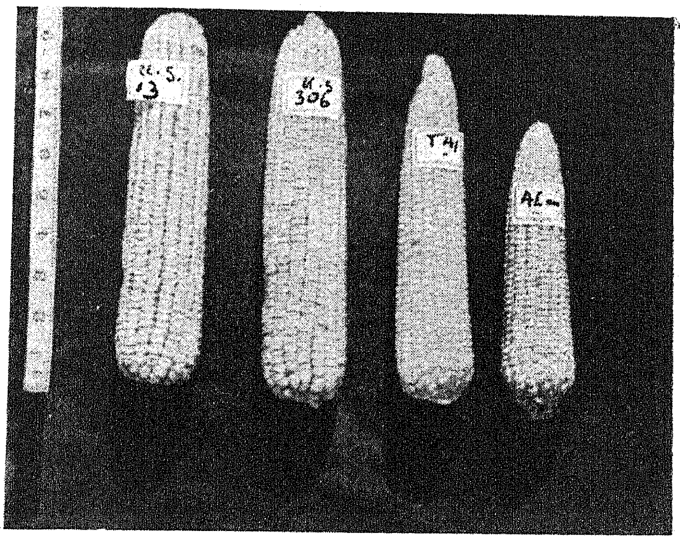
How was this miracle achieved ? By a long and strenuous programme of research work, carried out at a cost of nearly five million dollars to the U.S. Department of Agriculture. The old method of crop improvement was to select plants which showed desirable characteristics, and reselect from their progenies, and so on, until improved varieties were stabilized. Revolutionary changes in plant breeding work, however, have been brought about during recent decades as a result of the application of certain fundamental discoveries made about the middle of the 19th century by the Austrian monk, Gregor Mendel. Briefly stated, the principal concepts advanced in the Mendelian theory are that (a) the characteristics transmitted by the parents to the offspring, in both plants and animals, are determined by the unit factors, called genes, (b) the gene complements in the first generation of offspring from the same parents are similar, but (c) from the second generation onwards the genes segregate out in different combinations and patterns. The correctness of this theory has been amply verified by innumerable genetical experiments, and hybrid corn is one of the outstanding practical results.

BOSHI SEN is Director of the Vivekananda Laboratory, Almora.

Through work based on modern genetics, it has been possible to evolve new types of corn by combining several desirable characteristics and eliminating undesirable ones. For example, plants have been produced which have good roots and strong stalks, which are early or late as demanded by particular climates, which are resistant to diseases, and which have uniform vigour and high yield. But since in the progeny of hybrid corn plants, segregation takes place, hybrid corn for seed purposes must regularly be produced afresh. This is not only practicable, but an economically sound proposition, as proved by the results of the work in the U.S.A.

Almora trials

Different varieties of corn, like all other plants, have their own specific requirements of temperature, water and duration of the sunlight. Whether varieties of corn which have been evolved to suit the climatic conditions of different regions of the U.S.A. will do equally well in India, has yet to be determined by experimental trials in this country. Work along this line has been started at the Indian Agricultural Research Institute, New Delhi, and at the Vivekananda Laboratory, Almora. Small samples of the U.S.A. hybrid seeds, obtained through the courtesy of Dr Merle T. Jenkins, Corn Specialist, U. S. Department of Agriculture, were sown in June, 1948, in Almora, in replicated field plots, along with the local variety and one of the best U.P. varieties, T.41, seeds of which were obtained from Mr. M. A. A. Ansari, Economic Botanist, Kanpur. Seeds of the U.S. hybrid corn were also sent to several Experimental Farms in the United Provinces and to New Delhi for trials. Reports of these trials, indicate that as a result of the late monsoon in 1948 and excessive



Corn cobs grown in Almora. From Left to Right:
U.S. 13, Towa 306, U.P. T.41 and Almora Local

rain later on, there was either poor germination or the germinated plants became spoilt. The data obtained at Almora, on the other hand, were most encouraging. The observed yield per plant from the different varieties is given in Table I and the photographs of the cobs graphically illustrate the data given in the Table.

TABLE I

Yield per plant of different varieties of corn observed at Almora

Almora Local	T. 41	Min. 404	Towa 306	U.S. 13
0·77 oz.	3·91 oz.	3·01 oz.	6·73 oz.	9.09 oz.

It will be seen that compared to the Almora local, the yields of all the U.S. hybrids are unusually high, and compared to T.41, the yield of Min. 404 is lower, while that of Towa 306 is 72 per cent and of U.S. 13, 132 per cent higher.

Experimental trials with the U.S.A. and other hybrid corn should immediately be undertaken all over India, in view of our acute food shortage, and the necessity to conserve dollars for our industrial development. On the basis of Almora results, it would appear that by the use of hybrid corn seed, we can more than make up our 20 per cent deficit in corn, without increasing the acreage under corn cultivation.

The next question is, do we have to import our hybrid seeds, or is it possible for us to produce them in India? The main work is to discover and produce desirable parent seeds of pure breed (inbred parents) which can be used for producing the desirable hybrids suited to particular growing regions. Once the seeds of suitable parents are obtained, the mating of different parents is a simple process, well within the competence of an intelligent cultivator. For corn, unlike wheat, for example, produces separate male and female flowers on the same plant. The tassel, or pollen bearing male flower, appears at the terminal end of the plant and the female flower, the cob with its silken strands, branches out from the stalk further down. Fertilization of the cob with pollen gathered from a selected tassel presents no very great difficulty.

Double cross hybrids

To obtain hybrid seeds on a commercial scale, double cross hybrids are used, since inbred parents produce weak plants and the quantity of seeds obtained from crossing inbred parents is generally small. For double crosses, four desirable parents, say A, B, C, and D, of pure breed, are selected. When the cob of A is fertilized by the pollen of B, a single cross, AB, is produced. Likewise when C and D are crossed, the single cross CD is produced. Both AB and CD seeds will produce uniform vigorous plants. Cobs of AB plants fertilized by the pollen of CD plants then give the double cross, AB×CD. Since in this case both parents have hybrid vigour, an increased quantity of seeds is obtained, thus making the production of hybrid seeds a good commercial proposition.

Technique of production

The technique of producing hybrid corn is very simple. The basic idea is to fertilize the cob of the pure breed female parent by the pollen from the tassel of a different pure breed male parent. This is normally done by dusting the silk of the cob with the pollen. When several varieties of corn are grown in a single experimental plot, the silk strands, before they emerge from the cob, must be protected by paper or cloth bags for a few days only, to exclude any contamination by unknown pollen (which may be floating in the surrounding air or carried by visiting insects). Bagging is unnecessary, however, if plots at least 300 yds. apart are available. Then only two varieties to be crossed are planted in adjacent rows in a single plot. As soon as the tassels emerge in the plants selected for the female parent, they are simply pulled out by hand, and the cobs are then automatically fertilized by the pollen from the tassels left intact on the male parent. The cobs of the female plants will produce hybrid seeds—single crosses, if inbred parents have been used, double crosses, when single crosses are used as parents. In single cross plots, the cobs of the male parent plants will give inbred seeds. In double cross plots, the seeds produced in the cobs of the male parent should not be used again for sowing, but should be utilized for consumption.

Increase yield of corn obtained by the use

of hybrid seeds in the U.S.A. has more than repaid the extra cost of the seed production. A new industry valued at 70 million dollars a year, for producing hybrid corn seed, has grown up. In India, to begin with, production of hybrid corn seeds should be undertaken by our Government Farms. Later on, a few intelligent cultivators in every suitable corn-growing area can be taught how to produce hybrid corn on a small scale, to meet the local needs. This work might well be taken up by the *Gaon Panchayats.*

In the field work efficient help was rendered by Shri Bansilal Sah and Shri Udinath. The data were kindly analysed by Shri A. R. Roy, Statistician (A.H.) I.C.A.R., New Delhi. The expenses of this work were met from a grant from the Department of Agriculture, United Provinces, for my Scheme of Plant Introduction.

EXPLOITATION OF FISHERIES

FISHERIES, which can aid substantially to the food resources of the country, will receive special attention in Madras as a result of the steps now being undertaken to accelerate the fish production in the province. A special scheme has been drawn up in consultation with the experts of the Government of India whereby the internal production of fish in the province is expected to be increased by at least 50 per cent. Extension of the area of marine fishing is also envisaged in the scheme.

At present, the production of fresh water fish in the province is about 1,87,000 mds. This quantity can be substantially increased by better stocking of existing tanks and lakes with fry and fingerlings, and at a small expense. The scheme that has been drawn up proposes to give high priority to the collection, distribution and stocking of fry and fingerlings. Intensive stocking, preferably in small tanks and ponds, where they can be easily caught is proposed and all available water including about 30,000 tanks which the Provincial Government proposes to renovate for irrigation purposes under the Grow More Food scheme are to be put under fish culture.

In sea fishing, Madras has already made some progress as she produces about 60 per cent of the total sea fish caught in India. The quantity caught is, however, small as compared with the fishery potentialities of the Indian waters and the new scheme proposes special steps to extend sea fishing. Supply of country boats specially fitted for sea fishing, nets and yarn are proposed to be supplied in larger numbers. A small number of motor-boats will also be made and supplied to cooperative societies, especially on the West Coast for experimental fishing and demonstration. A small beginning is also to be made for fishing with modern powered-vessels.—*Food Bulletin*, August 1, 1949.

What the Scientists are doing

RESEARCH ON PULSES

PULSES play a vital role in Indian diet as they form the main source of proteins for the large vegetarian population in the country. India possesses a wealth of pulses such as *arhar*, *mung*, *chena*, *urad*, peas, horse-gram, etc. Since 1943 the Indian Council of Agricultural Research has been financing coordinated pulse research schemes in Madras, Bombay, West Bengal, the United Provinces, Bihar, Assam, Central Provinces, Orissa, Hyderabad, Mysore, Gwalior and Baroda with the object of producing high-yielding disease-resistant types possessing commercially desirable qualities. The value of some pulses in green manuring, rotation and mixed cropping was also taken up for investigation.

Madras: A scheme of research on pulses commenced in 1944 with the object of isolating high yielding strains resistant to disease and possessing trade characters such as bold size of grain, attractive colour, flavour and cooking quality. The pulses included are: tur, *urad*, horse-gram, *chena*, cowpea and *lablab*. The work is conducted at three centres in the province, viz. Coimbatore, Salem and Vizianagaram. The breeding work on pulses in Madras province from 1944-48 has resulted in the production of 46 promising selections in *arhar*, 8 in *mung*, 15 in *urad*, 120 in gram, 25 in *lablab*, 12 in cowpea and 48 in horse-gram which are under yield tests. At Salem four selections of *arhar* (35, 37, 56 and 59) which showed promise in the previous year have during 1947-48 given significantly higher yields than the control. The yields of gram per acre were 714, 786, 644 and 718 lb. respectively, while the control gave only 476 lb. Out of these, since culture No. 37 has been consistent in giving the highest yield, it has been sent out for trial at 21 centres in the districts under cultivators' conditions.

Under mixed cropping experiments a study of the economics of growing pulses alone or mixed with other crops such as cereals, groundnut, etc. were conducted. The results obtained over two consecutive seasons revealed that *arhar*, mixed with a spreading variety of groundnut, gave the maximum out-turn per acre.

United Provinces: Work on eight pulses, viz. *arhar*, *urad*, *mung*, soya-bean, moth, gram, lentil and pea has been in progress since April, 1943. Cooking tests on improved types of *arhar*, *urad* and gram were conducted in comparison with the local types. In *arhar* strain 17 W/2 produced the best *dal*, T66 ranked second, while 51 W/1 was third. In *urad* strain 12/5 was first for *dal*, while other two improved types 8B and NS 2/9 were only as good as the local. Of the gram selections, tested for cooking as well as parching, strain 87 proved the best and NP-25 and Banda were second and third respectively.

In the mixed cropping, *arhar* and broadcast *jowar* gave the highest out-turn during 1947-48 season. In rotation experiments, the results again indicated the beneficial effect of a preceding pulse crop. The highest yield of fodder *jowar* was obtained after an *arhar* crop preceded it.

Assam: High yielding strains of *arhar* have been produced of which mention may be made of R-3b with an yield of 912 lb. and R-7 which gave 658 lb. per acre as against the mean yield of 572 lb. for all the strains tested.

Bihar: Arhar varieties were classified into three types—early, medium and late according to their time of maturity. The late types were further divided into erect and spreading. Four selections in early, 9 in medium, 15 in late (spreading 8 and erect 7) types have been obtained with potentialities for high yield which will be tested. In peas 10 good strains suitable for general cultivation have been established.

Central Provinces and Berar: Improved strains of *tur* No. 31 and Hyderabad P.E. have given the highest yield of 507 lb. per acre which represents an increase of 48 per cent over the control E.B. 3. A strain of *mung* gave about 166 per cent more yield than the control variety. A strain of *urad* (No. 55) yielded 500 lb. per acre, i.e. 172 per cent more than the local variety. Strain No. 88 of moth yielded 272 lb. per acre which is 61 per cent more than its control. Wilt is a great menace to *tur* and causes heavy losses every year particularly in the wilt-infected areas of Berar. A strain No. 31 has been evolved which combines high yield with resistance to wilt; it gave 48 per cent increased out-turn per acre over control and the lowest infection of 2·3 per cent wilt attack.

East Punjab: The wilt disease causes serious damage to the gram crop in East Punjab which is estimated at over two crores of rupees annually. A scheme is being financed by the Council since 1943 to investigate the life-history and causes of gram wilt and devise simple measures for its control and discover varieties resistant to it. It is reported that experiments conducted for the fifth year in succession have failed to establish a pathogen as the cause of gram wilt as it occurs in the Punjab. Non-biological agencies such as unfavourable soil conditions, deficient soil moistures and high temperature at the time of sowing and towards the end of the gram season are considered by the workers to be the main causes of wilt in gram. (R.S.)

WATER REQUIREMENTS FOR CROPS

In order to step up food production in the country, the Standing Advisory Committee for Research on Water Requirements of Crops has decided that research on water requirements of crops should at present be particularly concentrated on the optimum use of irrigation water so as to obtain the maximum yield of crop from a given quantity of water.

It has also been decided to frame standards for layout of trials, measurement of water, temperature, humidity etc., to enable results of experiments carried out at different stations to be compared.

In a resolution passed by the Committee, it has asked Provincial and State Governments to request their Chief Engineers and Directors of Agriculture to meet and formulate proposals for the problems on which they would like research to be carried out in connection with the optimum use of irrigation water. It has been suggested that they should select three or four farms for these experiments in their respective administrations representative of the conditions prevailing in the whole area. To ensure effective coordination for the carrying out of these experiments it has been stressed that provision of staff at each station should include a representative each of Departments dealing with irrigation, agriculture and meteorology. A special feature of the new studies will be the malarial aspect of water standing in irrigated fields and channels.—*Food Bulletin*, August 1, 1949.

You ask We answer

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and States. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. Could you please give information on the causes of rust in wheat, and its remedy? (G. S.)

A. Rust is caused by the wind-borne spores of parasitic fungi.

Three forms of rust, black (*Puccinia graminis tritici*), yellow (*P. glumarum*) and orange or brown (*P. triticina*) are found in India. Black is found in all parts of the country, in hills as well as on the plains. Brown also is noted everywhere except perhaps in a small part of the Peninsular India. Yellow and brown rusts are common in the Punjab, while all the three are found in the United Provinces and Bihar. Black rust is, however, predominant in the plains of the United Provinces and Deccan. These rusts, particularly the black and yellow, cause considerable damage in the areas where they occur, their intensity depending upon the prevailing weather conditions. Though palliative measures like the eradication of alternate and collateral hosts of the disease, application of fungicides and cultural and cropping practices may be practiced, the main remedy lies in breeding varieties of wheat resistant to these rusts. But the problem is much complicated by what are called the physiological races in these three forms of rusts, each of which have distinctive infective potentialities different from the other. Nine races of black rust, eight of brown and ten of yellow have already been identified in India. But, India is fortunate to possess a highly resistant variety of indigenous wheat, the Kapli variety, which has been largely used as one of the breeding partners in most of the rust-resistant hybrids. In the schemes financed by the Indian Council of Agricultural Research since 1934 and worked in Simla, Bombay and in the Central Provinces, the main aim was to breed such strains of wheat as would be immune or resistant to these physiological races, especially to all the races of the three rusts put together. Already, a fair range of improved varieties resistant to one or the other rusts separately have been evolved for the wheat growing tracts and adopted by the cultivators. A coordinated All-India Scheme to tackle the problem in a comprehensive way is now under the consideration of the Government. (I.C.A.R.)

SALVATION THROUGH IRRIGATION

THE Indian Union tops the list of the nations of the world which have substantial irrigation systems. According to latest available estimates, the acreage under irrigation in India exceeds the combined total acreage irrigated in the U.S.A., U.S.S.R., Japan, Egypt and Italy—some of the leading countries in this field. These five countries between them occupy roughly ten times the total area of the Indian Union.

Despite the country's supreme position in this field, the amazing fact that has long stared Indian economists in the face is that, on the whole, the yield per acre in India is about the lowest in the world. What is the explanation of the phenomenon that a country which has the world's finest and largest irrigation system, groans under the weight of heavy imports of foodgrains from abroad year after year ?

Capricious nature

The explanation is simple enough. For every acre of cultivated land under food crops in the country receiving its water supply from irrigation canals or tube-wells, there are many acres which are unirrigated and have to depend for water supply upon the rains. The rainfall is very unevenly distributed. Then, the rains may arrive too late or too early. Having arrived, the rains may be too light or too heavy. Consequently, there may be partial or complete famine, or, if the monsoon is heavy, there may be floods. In either case, food crops suffer. Crippling imports to make up the deficiency between demand and supply thus becomes necessary.

The tragic regularity with which crops in India have in recent years suffered from one cause or another, either from drought or from a heavy downpour, is well known. Must the nation ever remain a mute witness to recurring havoc caused by famines and floods ?

Lasting solution

The only lasting solution of the country's troubles would appear to lie in the gradual reduction, and eventual elimination, to the largest extent possible, of the cultivator's direct dependence on rain and his being provided with an alternative source of water supply which has the minimum element of uncertainty in it, preferably round the whole year. In other words, the solution would appear to be to have extensive irrigation systems in those parts of the country which are at present poorly irrigated. Then only, with an adequate and steady flow of water assured to him, can the cultivator in India become an effective participant in the drive to produce more and ever more food.

Many foreign countries, faced with similar problems of controlling floods, forestalling famines, and increasing the acre-yield of their land, have found a solution through elaborate systems of controlling their rivers and regulating their waters with the help of large reservoirs and canals.

The reader in India is familiar with a number of multi-purpose river valley projects which various provinces and States have on hand. These are designed to control floods and provide large-scale additional irrigation, hydro-electric power for agriculture and industry, and facilities for fish culture, inland navigation, afforestation, soil conservation, etc.

New projects

The Central Waterpower, Irrigation and Navigation Commission, which is India's national agency for the multi-purpose utilization of water resources, some time ago invited the Chief Engineers of provinces and States to furnish complete data regarding the projects they had under execution, investigation or contemplation. The object was to draw up a seven-year programme which would give top

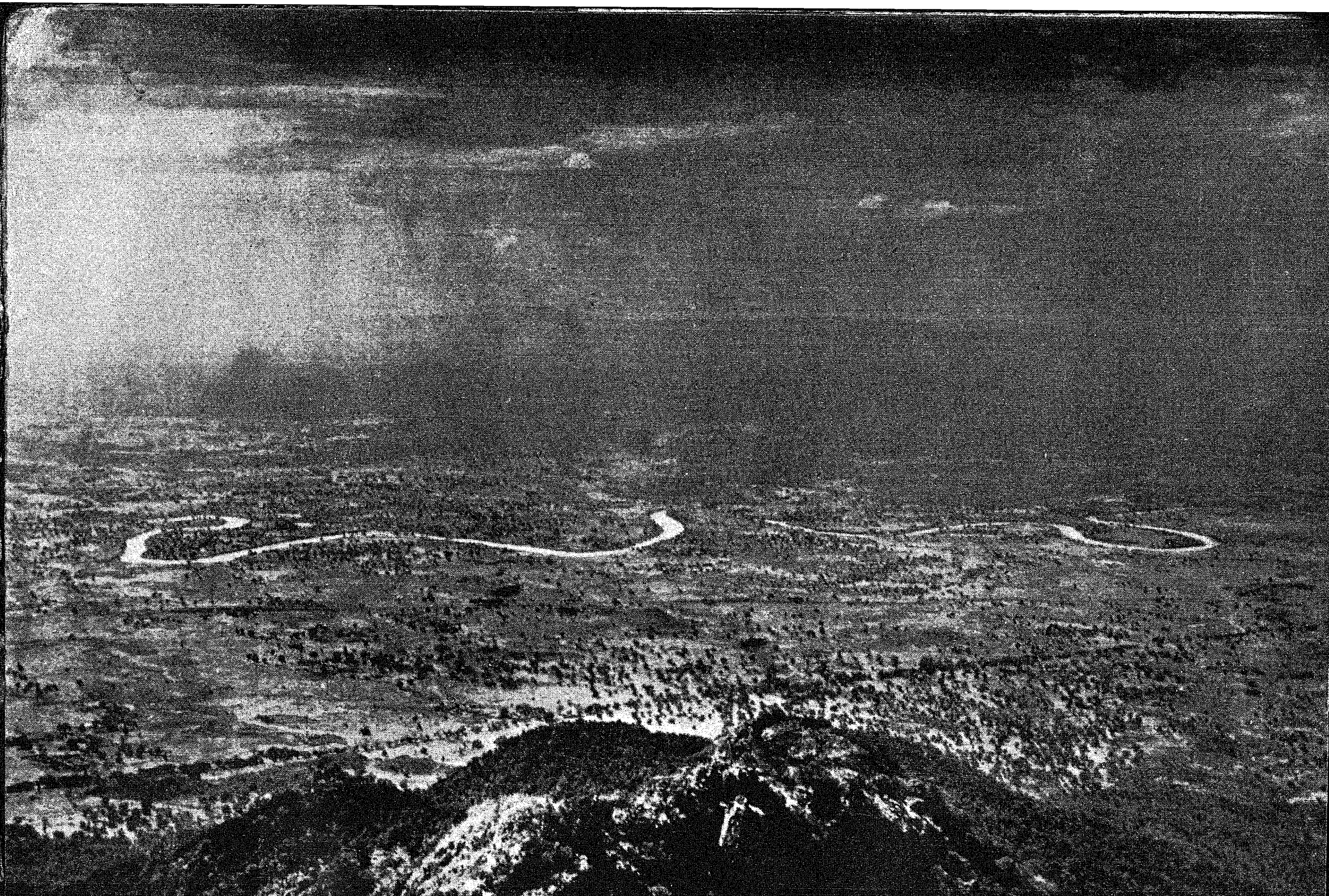


PLATE 52 View from the top of the Parasnath Hill, showing some of the uncultivated land that will be irrigated by the Damodar Valley Scheme

PLATE 53

Damodar Valley: Survey party at work near the Konar Dam site.

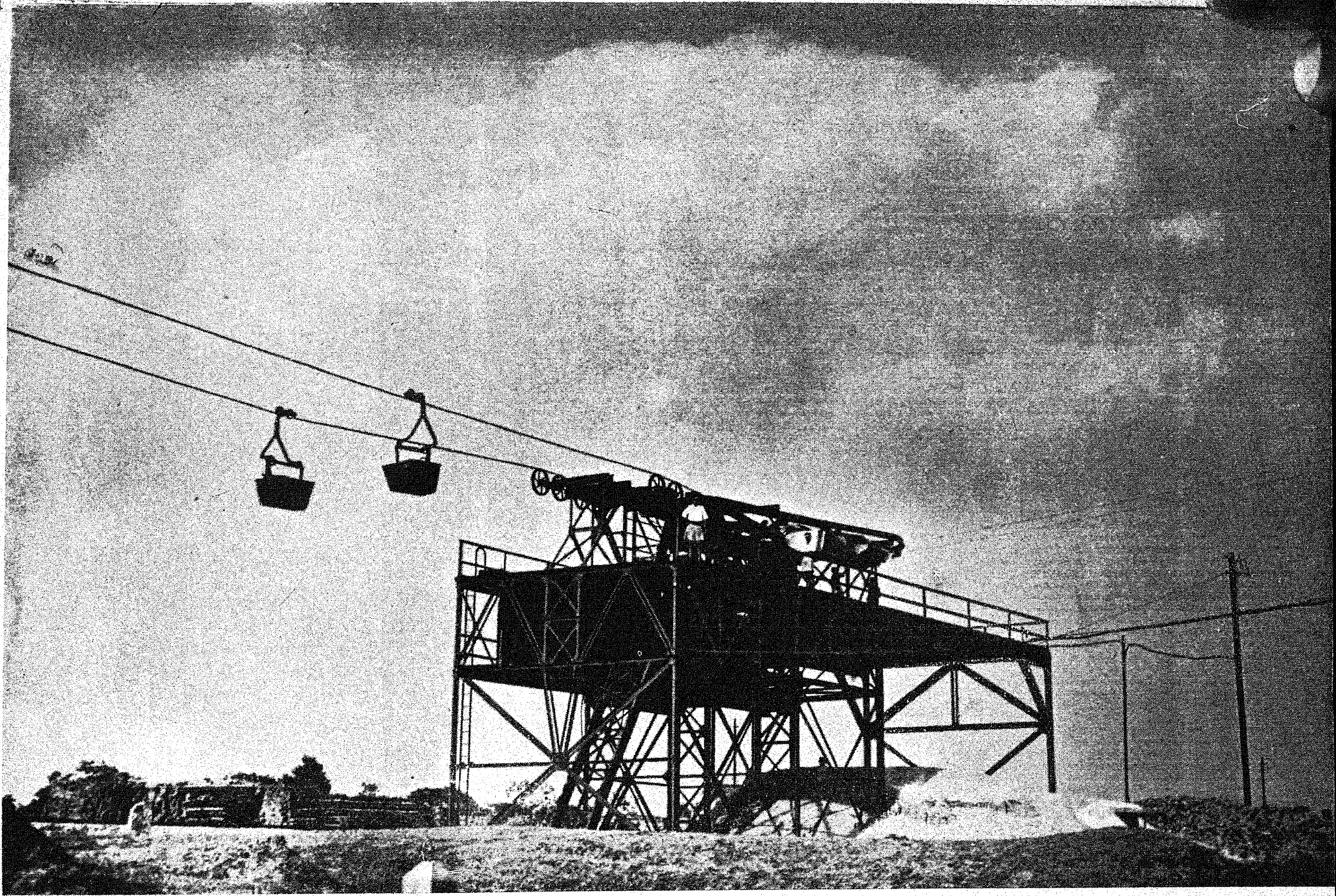


PLATE 54 Sand-stowing head in a Jharia Colliery. Sand is received at this end through a ropeway from the Damodar River-bed and blown into the mine-shafts and tunnels

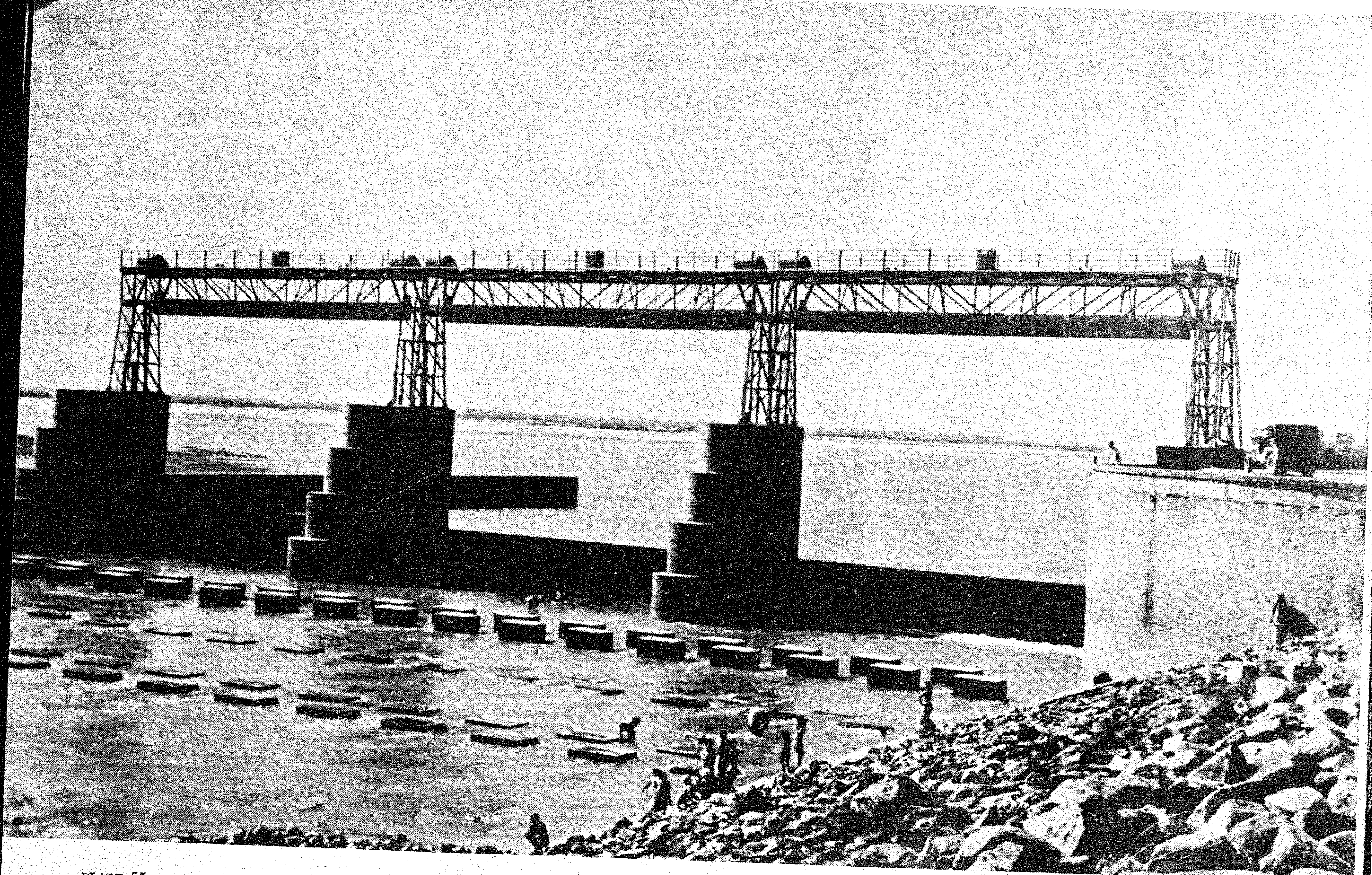


PLATE 55

The Anderson Weir on Damodar River in Burdwan District, West Bengal.

priority to projects promising the quickest yield in foodgrains.

According to information received, there are in all 160 projects under execution, investigation or contemplation. Many of these are purely irrigation or hydro-electric projects. Out of these 160, 46 are actually under construction, 53 have reached advanced stages of investigation, and in the case of the remaining 61 investigations have just begun. The total cost of all these would be in the neighbourhood of Rs. 1,280 crores.

When all these projects are fully developed, the country will boast of additional irrigation to the tune of over 25 million acres (approximately equivalent to the entire area under irrigation in the U.S.A. at present). The additional yield of foodgrains and hydro-electric power would be five to six million tons and about 10 million kilowatts respectively. The revenue from this additional food and power has been estimated at Rs. 135 crores per annum (on an investment of Rs. 1,280 crores).

Out of the 46 projects under construction, 17 are expected to cost less than Rs. 1 crore each, 16 between Rs. 1 and 5 crores each, and four between Rs. 5 and 10 crores. The average cost of these 37 works out roughly to less than Rs. 1·5 crores per project. The remaining nine are comparatively large projects and are expected to cost anything between Rs. 10 and 100 crores or more each. Among these, nine, covering some of the potentially richest parts in the east, west, north and south of the Indian Union, are the Damodar Project in West Bengal and Bihar; the Hirakud Project in Orissa; the Rihand Project in the United Provinces; the Bhakra and Nangal Projects in East Punjab; the Tungbhadra Project in Madras and Hyderabad; and the Mor Project in West Bengal.

Food production from 1950-51 onwards

What will these 46 projects achieve and how soon? Present calculations show that while the smaller ones may be completed in between two to three years, some of the bigger projects may take seven years or a little more, provided the supply of construction materials like cement and steel is forthcoming according to a schedule drawn up by the Ministry of Works, Mines and Power.

The estimated requirements of steel and cement are above one lakh tons and six lakh tons respectively per annum for seven years. Funds required would be approximately Rs. 50 crores per annum for this period.

Food production from some of the projects is expected to start coming in as early as 1950-51. From about 173,000 tons during that year, the additional food yield is likely to increase almost eightfold to about 1,380,000 tons by 1955-56. On completion, these projects will enrich India's granaries by an aggregate of some three million tons per annum—slightly more than imports of foodgrains from abroad during 1948-49.

Besides, nearly 1·85 million installed kilowatts of new hydro-electric energy would become available on completion, nearly doubling the present installed capacity of hydro-electric plants throughout the Indian Union.

Minor adjustments possible

As increased production of food is today the paramount need, it is likely that minor adjustments in the execution of even these 46 projects will be found necessary. For instance, work on portions of a project relating to power may be slowed down, and the available resources concentrated on its irrigation aspect. In addition, sponsoring administrations may be left to execute the smaller projects costing less than Rs. 5 crores without calling upon the Central Government for financial aid. In that event, the Centre will be left to exercise control only in respect of a small number of projects costing over Rs. 10 crores.

While it is too early to anticipate Government's decision, the probability is that, in any case, all the 46 projects under construction will be allowed to go forward. It is easy to imagine what the additional food and electricity produced through these would mean to the country's economy and its programme for industrialization.

True economy

During 1948-49, the Government of India had to spend Rs. 120 crores to import 2·8 million tons of foodgrains from overseas. According to present indications, the expenditure on imported foodgrains during 1949-50 may go up to Rs. 150 crores, and the quantity imported may be as much as four million tons.

A question that may well be asked is: Is India, with an accumulation of so many difficult problems to solve, in any position to spend Rs. 370 crores (estimated expenditure in seven years) on these 46 projects, and perhaps further amounts if more projects, which are ready for execution, are taken in hand? A realistic answer to this question can only be provided by a counter-question: Is the country in any position to go on spending Rs. 150 crores or so *per year* on imported foodgrains, especially when substantial portions of this money have to be found in precious dollars?

There appears to be no alternative to river development projects on a large scale, if production of food is to overtake the growth of population and if cheap power is to be made available for agriculture and industry. This conclusion becomes irresistible when it is remembered that many of the river valley projects will not only give the country the two vital requisites of progress just mentioned, but also a number of other subsidiary, but in the long run no less important, advantages like fish culture, afforestation, soil conservation, internal navigation, provision of drinking water in parts of the country, recreation facilities, etc. (*P.I.B.*)

SARVODAYA PRADARSHNI AT JAIPUR

CHATTAR SINGH SIDHU

THE *Sarvodaya Pradarshni* arranged, in connection with the Fifty-fifth Session of the Indian National Congress at Gandhinagar (Jaipur), in the third week of December, 1948, was the first of its kind in free India. It was a grand show full of utility and educative value. The visitors, to whatever walks of life they belonged, were markedly impressed with what they saw.

It was comprised of the following sections:

1. Model village
2. Sanitation
3. Village culture
4. Village industry
5. *Khadi*
6. *Adi-vasee*
7. *Nai taleem*
8. Nature cure and ayurved
9. Women and children's home
10. *Gram-udyog bazar*
11. *Gosewa* and agriculture
12. Rajasthan court (art and culture of Rajasthan)
13. Bapu *mandap* or *Sarvodaya* literature

Agriculture and *Gosewa* Section with which the readers of *Indian Farming* are mostly interested, was the biggest Section spreading over five courts, each court measuring 100 ft.× 150 ft. This Section comprised of stalls which the various research and development sections of the Ministries of Agriculture, Food and Health, Government of India, and Agriculture and Veterinary Departments of Provincial Governments and States had put up in the spacious squares. Every stall had some material at least of definite interest for the visitors. A short account of some of the exhibits is given below.

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Tomatoes

The Indian Agricultural Research Institute, New Delhi, exhibited some superior varieties of tomatoes which they had developed by crossing with a wild strain from America. Two of these varieties T.S. 16 and T.S. 21, were said to be richer in vitamin contents and sweeter than the local ones and were less susceptible to frost.

Fuel gas plant

A small model of the Fuel Gas Plant exhibited by the Indian Agricultural Research Institute was very interesting. If this cuold be finalized into a practical proposition, it would be a boon for the village people and would go a long way in improving their ways of living.

Cattle dung mixed with water is placed in a drum where after decomposition it gives rise to a mixture of gases (hydrogen, carbon monoxide and methane) all inflammable, producing a

non-luminous flame. These gases are collected and stored in another drum from which they are utilized for lighting and generating heat for cooking in houses. If the scheme works, one or two such plants in a village could meet the entire household requirements of light and fuel thus putting an end to an obstinate problem of burning dung. In this process the dung is also not wasted. The refuse left after gas formation is a thoroughly rotten manure which is said to contain 1·5 per cent nitrogen, 1·36 per cent P_2O and 0·7 per cent K_2O.

Food and nutrition

The demonstrators of the food and nutrition stall explained to the visitors the various groups of food materials rich in various classes of vitamins and the deformities and diseases prevalent in animals and human beings on account of insufficiency or want of such vitamins. This stall distributed free some literature published on human diets as recommended for different classes of workers, labourers, small families, mothers, children, etc. Two of these, one for agricultural labourers and the other for suckling mothers, are reproduced below for the interest of readers.

Cheap diet for labourer (agricultural)

Cereals	...	12 oz. (wheat, rice, maize, etc.)
Other cereals	...	4 oz. (*jowar, bajra*, etc.)
Pulses	...	2 oz. (red gram, lentil, *arhar*, etc.)
Roasted gram, Sprouted gram	...	4 oz. (Mainly used as breakfast and afternoon snack)
Leafy vegetables	...	4 oz. (*lal sag*, and other *sags*. Also green *sag* consumed raw during winter season)
Other vegetables	...	6 oz. (brinjal, gourd, pumkin, lady's fingers, etc.; potato when comparatively cheap)
Fats and oils	...	1 oz. (generally mustard oil. But no objection to *til* and *mahua* oil, etc.)
Fruits	...	4 oz. (*kakri, kharbuja*, guava, *jamun*, mango, papaya, etc.
Butter milk	...	8 oz. (*lassi* from skimmed milk or *dahi*)
Jaggery	...	2 oz.

Note: The calory value of this diet comes to about 3,000.

Diet for suckling mothers

Cereals ...	...	...	7 ch.
Pulses ...	...	...	$5\frac{1}{2}$ ch.
Leafy vegetables	...	...	2 ch.
Other vegetables	...	...	3 ch.
Ghee or oil	...	...	1 ch.
Milk	...	...	10—12 ch.
Sugar or *gur*	...	...	1 ch.
Fruits and nuts	...	...	2 ch.
Eggs ...	...	...	1
Meat or fish	...	...	1 ch.
Condiments	...	...	For taste

Note: 1. Drink plentiful water.
2. Two *chhataks* of milk and one *chhatak* of fruit to be taken more by vegetarians instead of meat, egg and fish.

Wooden chakkies

Unpolished or brown rice, i. e. partially pounded rice, which has now been agreed by all scientists to be much more nutritious, delicious and richer in vitamin B_1 content than the polished rice, was also advertised. A stall of the Wardha Gram Udhyog exhibited wooden *chakkies* to produce brown rice of the desired quality. These were just like the ordinary stone *chakkies* with this difference that in these cases hard *shisham* wood replaced the stones. These afforded a practical solution for securing healthy and richer type of rice. Such *chakkies* are procurable from Wardha.

Fruit preservation

A small and compact stall of the Vegetable and Fruit Preservation Section attracted large crowds of visitors. Demonstration of the proceses of preparation of the preserves was the speciality of this stall. A small but useful booklet giving brief instructions for preparing the various squashes, juices, marmalades, *chutneys*, pickles, jams, and jellies, etc. was distributed at a nominal cost of one anna.

Land improvement

The stall of the Bombay Provincial Department of Agriculture was conspicuous for its original and valuable work on soil preservation,

contour bunding (against erosion), dry farming and land improvement work in Bombay Province. The charts, graphs, and models exhibited were very instructive. Prospectus and Syllabus of the Soil Conservation Institute at Sholapur were distributed free. This Institution run by the Bombay Provincial Government is imparting training in land improvement to *bona fide* cultivators, Agricultural Assistants, Science or Agricultural Graduates and Agricultural Officers. The Syllabus includes a thorough study of soil erosion, land surveying, soil engineering, dry farming methods and practices, contour strip cropping technique, reclamation of waste lands and forestry and range management

The United Provinces Irrigation Department had taken sufficient pains to lay out skilfully a spacious and beautiful model of ridges, rivers, bunds, weir and head-workers, etc. to show in an interesting way how unruly and wasteful rivers can be tamed and diverted to useful and productive ends.

Gur

The Agricultural Department of the United Provinces exhibited various samples of *gur* and *shhakkar* (powdered *gur*) of very superior quality. The actual processes of cleaning and clarification of juice and of making *gur* of the requisite quality were demonstrated at the spot. *Gur* is a valuable food of the rural people. Being more nutritious and cheaper than white sugar, it has scope of entering into the dietary of the middle classes also, if production of superior quality *gur*, without appreciably enhancing its price, is encouraged. White sugar so saved or released may be exported out of the country to secure foreign exchange to the general benefit of the country as a whole.

Palm gur

The Palm *Gur* Adviser to the Government of India demonstrated how *gur* was prepared from the juice of palm trees. It is a delicious and nourishing type of *gur* as good in colour and form as the cane *gur*.

The production of palm *gur* is an ancient village industry of this country which flourished well, particularly in Bengal. Each palm tree can yield about 10 to 15 seers of *gur* annually. The process of preparing *gur* is quite simple. A cut or an incision is made in the stem of the tree and an earthen pot is fixed below it to receive the juice that oozes out and trickles into the pot. This juice is collected from a number of trees and after every 24 hours boiled, clarified and concentrated into *gur* in the usual way.

A booklet entitled *Palm Gur* published by the Ministry of Agriculture contains detailed information about this industry for the benefit of interested persons.

Compost-making

The various stages of compost preparation were shown with the help of pits and trenches. The conservation of liquid manure, i.e. animal urine was demonstrated by means of straw beds and sand-beds spread under animals and a placard with the words 'compost is incomplete without urine' was fixed at the compost pit to drive home the idea.

Animal nutrition

The Indian Veterinary Research Institute, Izatnagar, exhibited charts depicting original work on animal nutrition, feeding, etc. The rations worked out by them for a cow, a bullock and a bull are of practical utility to farmers and dairymen. The figures are given in the Table below :

Animal	Hay or dry fodder	Green grass or silage	Concentrate mixture
Cow (Maintenance)	8 lb.	25 lb.	$1\frac{1}{2}$ lb.
1 lb. of additional concentrate for every $2\frac{1}{2}$ lb. of milk.			
Bullock (working for 6 hours.)	10 lb.	20 lb.	$6\frac{1}{2}$ lb.
Bull	10 lb.	30 lb.	5 lb.

The Institute has evolved a simple method of increasing both the nutritive value and the digestibility of wheat *bhoosa* and paddy straw by about 50 per cent by treating these straws for 20 to 24 hours with 1 per cent solution of caustic soda.

Dairy development

The Dairy Development Section of the Central Government demonstrated in an impressive way the sanitary *than* of cow (cowshed), clean and hygienic milking, processing of

milk in its various stages, sterlization of dairy utensils and apparatus, preparation of various milk products and testing of milk against adulteration and contamination. A beautiful model of a largescale commercial dairy farm was also exhibited. The Cattle Utilization Section likewise exhibited various feeds and fodders and veterinary aids necessary for the proper feeding and health of the cattle.

Jaipur Agricultural Department

In the stall of the Jaipur State Agricultural Department was displayed a big soil and crop map of the State which showed at a glance the various zones of soil types and crops produced in these zones. Among some marvellous achievements of the Department, as evident from the charts displayed in the stall, mention may be made of the following:

(a) Co. 312 variety of sugarcane, which was introduced only five years back, has now not only replaced the entire area under local cane in this State but has also spread over more than four times the area originally occupied by the local variety.

(b) C. 591 wheat, introduced in 1945, has now occupied about half the total area under *desi* wheat and is expected to cover the entire area in the next couple of years.

The Agricultural Department of the State had also arranged a cane juice bar at which sugarcane juice was sold at a nominal cost of annas two per glass.

The Jaipur State and the United Provinces Agricultural Departments utilized the spacious courts housing their respective stalls with model fruit orchards exhibiting actual living plants, the different systems of spacing, the irrigation methods and the various methods of propagation.

Cattle show

A cattle show comprising of bulls, cows and heifers of Hariana, Namari and Nagauri breeds was held. There was a milking competition for cows. Cart and camel races, held for the first time in Jaipur, were arranged for the entertainment of villagers. This aroused considerable enthusiasm and interest and drew large crowds of spectators. There were as many as 29 entries for the cart race. Decent prizes were awarded to the winners of the first three positions in each race.

Visitors

As reported by the Exhibition Managing Committee, about 1,25,000 people visited the exhibition. It was indeed interesting to find visitors coming from the remotest corner of the country like, Kashmir, Assam, Junagadh, Tamilnad (Madras), Puri, etc. clad in their characteristic costumes. Besides several Congress leaders and distinguished visitors, the Hon'ble Prime Minister and the Hon'ble Deputy Prime Minister graced the exhibition with their presence.

Credit for the success of the *Gosewa* and Agriculture Section of the Exhibition goes to Shri Radha Krishnaji Bajaj and Shri B.S. Deshpande of the All-India *Gosewa* Sangh.

COCHIN

N. SANKARA MENON

THE State experienced a severe drought in the month of March, 1949 and the *Kole* and *Puncha* crops of paddy cultivated during this period suffered to a very great extent. All the sources of water dried up and the cultivators were rendered helpless. The crop over a considerable area dried up and the yield was reduced. The area under cultivation was about 20,000 acres and the total yield was expected to be even less than 50 per cent of the normal. This was a great blow both to the cultivators and to the Government in these days of food scarcity. The calamity was all the more severe since the cultivation of *Kole* and *Puncha* paddy

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entailed comparatively more expenditure than that required for paddy grown during the other seasons.

Subsidy on manures

A subsidy of 25 per cent on the selling price of manure was given by the Government in order that the manure might be utilized for the paddy crop. To induce the cultivators to use more manure and to increase production, this subsidy was raised to 50 per cent for manures to be used for *Kole* and *Puncha* paddy. The manure was issued in the form of a mixture consisting of groundnut cake, ammonium sulphate and bonemeal. The services of teachers trained in agriculture were requisitioned to conduct propaganda and supervise manuring. All the Officers of the Department concentrated their attention on this work during this period. About 400 tons of manure were sold and the manured crop came up well.

There was a serious attack of blight disease in the initial stages over a considerable area; but the crop recovered to a great extent later on. The drought was severe and the crop was considerably affected. Partly due to disease and mostly due to drought, manuring could not appreciably increase the yield.

Production of compost

Compost was prepared by a few Municipalities in the State. In order to augment food production the Government decided to open other centres for compost-making. An Officer was appointed to be in charge of this work alone. The Scheme has only just started working and it is expected that the production of this valuable manure will be increased considerably. Propaganda is conducted to prepare compost in villages also and all the Officers of the Department are inducing cultivators to convert all available organic refuse into manure. A sum of Rs. 16,500 has been provided by the Government for the preparation of compost in the State.

Green manure

The advantages of using *daincha* (*Sesbania aculeata*) as a green manure crop for paddy have been realized by a few cultivators in the Chittur Taluk. The yield can be considerably increased by using this crop as a green manure. The seed is not produced in the State and there was some difficulty in getting a supply from the adjoining Madras Province. One hundred bags of this seed were secured by the Agricultural Department for sale at half price to induce cultivators to grow this crop and increase food production.

Land Development Board

The production of more food is one of the most important problems confronting the country now and a larger area has to be put under cultivation if sufficient food is to be produced. The use of more manure, improved seeds and control of pests and diseases will increase the production to some extent; but there will be no lasting solution of the food problem if the area under cultivation is not increased. A Board has been formed to work out details for bringing more area of the State under food crops and it is estimated that 60,000 acres more can be put under food crops at an early date. The Honourable Prime Minister of the State who is in charge of Agriculture is the Chairman, and the Board had its first sitting recently. Details for bringing the scheme into operation are being worked out. The Diwan Peishkar, Director of Agriculture, Conservator of Forests and Irrigation Engineer are members of the Board. A major portion of the area will be available as a result of clearing the forests.

ASSAM

S. R. BAROOAH

THE Assam Government, recognizing the value of exhibitions as a means of propaganda to disseminate knowledge to the public at large, have initiated a string of agricultural exhibitions in the province. Thus, during the months of December, January and February a number of such exhibitions were held to popularize scientific agriculture.

Exhibitions at Titabar and Karimganj Farms

In these Government Farms both research and multiplication of paddy are being carried on. The exhibitions were held in the Farms on 1 December, 1948 and 16 January, 1949 respectively. The main purpose of the exhibition was to popularize recommended paddy varieties and also to demonstrate the best cultural methods in the fields. People from the neighbouring villages attended the exhibition in large numbers. A meeting was also convened where the improvemnts in agricultural practices were explained.

Exhibition at Gauhati

The annual agricultural and Industrial exhibition of the Department of Agriculture was held this year at Gauhati on 6, 7 and 8 January, 1949. It was a grand success despite bad weather. The Premier of Assam opened the exhibition with an appeal to the people in general to adopt the improved methods of agriculture. Besides Agriculture, exhibits of other departments like Industry, Basic Education, Forest, Public Health, Weaving, Sericulture, Tanneries and many others were exhibited. Next year it is proposed to hold the exhibition at Silchar, Cachar.

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A number of exhibitions organized by the public were also held during these months, the most noteworthy being the one held at Bidyapur. This exhibition was organized by the people with the help of the *Zamindar*. The Agricultural Department also participated in the exhibition and demonstrated many improved methods of cultivation and improved seeds.

Boro and Bao paddy cultivation

Some parts of Assam are always flooded during the monsoon when many rivers are in spate. The worst affected part for the last few years is Nowgong district which gets flooded by the rivers Kapili and Kolong. Every year the Government has to rush food to this locality, and there is always a scarcity of food. This happens because the flood water comes during the growing season of the *Sali* (transplanted winter paddy). To remedy this situation the Department of Agriculture has been trying to popularize the cultivation of *Boro* and *Bao* paddy (spring and deep-water winter paddy).

There is a large acreage of land in Assam that can be brought under these two crops. The Department is trying very much to bring all the available *Boro* and *Bao* land under cultivation this year, and for this purpose the Agricultural Engineering Section has bought a number of pumps for irrigation. If *Boro* and *Bao* paddy is successfully cultivated in the available land, the floods will no longer be a menace to the cultivators, and the Province will be better off so far as food is concerned.

Across the Borders

FARM BUDGETING

By P. C. DRUCE

PLANNING for the future is as important in farming as it is in any other type of business. The successful city businessman does not leave things to chance; he does not adopt a particular production programme for the year simply because he did the same thing the year before! He looks at his markets, his resources and his costs, and he decides on that programme of production which he anticipates will return him the greatest profit. Why should the farmer not do the same thing?

By the very nature of his work, every farmer, often perhaps without realizing it, does in fact, plan or prepare for the future. Frequently, however, no thought is given to definite planning, the farmer simply doing what was done in the previous season without paying any real regard to the fact that circumstances may have changed—and without making any attempt to ascertain whether the programme adopted in the previous season yielded the highest possible profit, having regard to the circumstances and to the amount of work and effort the farmer was prepared to expend. Often when plans are made they are not put on paper, nor are they carefully considered. Their preparation is, in fact, frequently far too haphazard to be sound.

There is no necessity for the planning of future farm operations to be either haphazard or unmethodical. A simple method is available whereby the farmer can plan for the future, either for the forthcoming year only or for a much longer period ahead. This method of technique is known as 'Farm Budgeting'.

What is a budget

A budget is simply an estimate of probable receipts and expected expenditure in a future period. That period may be three months, or a year, or five years; however, the most common period for which a budget, whether a farm budget or any other type of budget is prepared is for a period of twelve months.

Why prepare a budget?

A businessman periodically prepares, for his own use, a statement of probable receipts and expenditure, which will vary according to the production programme he decides upon, and he uses such a statement to ascertain the programme he should adopt so as to obtain the greatest possible profit during the period for which he is planning. In exactly the same way a farmer may put down on paper his anticipated receipts and expenses under various programmes or systems of farming, with the object of ascertaining which particular system of farming or combination of enterprises is likely to yield the greatest net profit under the circumstances which he anticipates will exist for a period of twelve months ahead, and in some cases for a longer period.

The preparation of a farm budget also enables the farmer to estimate in advance the returns that may reasonably be expected from any system of farming, under changed circumstances and conditions affecting farm costs and returns are continually changing.

Any budget is necessarily of a tentative nature and this applies to the businessman's budget just as much as it applies to a farm budget. Many farmers think that, because of the uncertainty which surrounds some of the factors used in the preparation of a farm budget, it is not worthwhile putting future programmes on paper. The fact remains that budgeting does enable a farmer to see the value of alternate methods of organization of production and to decide which is most likely to prove the most profitable.

There are a number of other specific advantages of farm budgeting. A budget helps a farmer:

(1) To determine in advance how much seed, fertilizer and other supplies he is likely to need during the year.

(2) To determine how much feed will be needed for livestock, how much must be bought, how much may be expected to be produced on the farm, and how much is likely to be available for sale.

(3) To determine the amount of cash that will be needed to operate the farm and also when it will be needed so that the necessary financial arrangements may be made.

(4) To determine the total net returns that may be expected, so that living expenses, payments or investments, may be adjusted accordingly.

(5) To keep a good balance between crops in a crop system of farming, and a good balance between crops and livestock in a crop and livestock system.

(6) To plan his labour requirements well in advance and, to a certain extent, it enables him to avoid unduly heavy casual labour requirements at any one particular period of time, in other words, the preparation of budget may help to spread labour requirements more evenly throughout the year.

Farm budgeting is really a very simple process, and the few hours that need to be devoted to it each year are likely to be well spent; it is conceivable that, on some occasions, budgeting may save the farmer who takes the trouble to undertake the small amount of work involved, many hundreds of pounds.—Reproduced from the *Agricultural Gazette of New South Wales*, September 1948.

CULTIVATION OF 'DIFFICULT' LAND

CULTIVATION of land infested with weeds or left with stubbles of previous crops is likely to be easier as a result of improvements made in the double plough recently invented by the Indian Agricultural Research Institute of the Central Ministry of Agriculture. The plough which consists of the bottoms only of two standard *desi* ploughs suitably coupled by means of an iron framework and pulled by a single central beam has been further modified now so that most difficult fields can be tackled with ease. It has been successfully tried in a number of cultivators holdings around Delhi.—(*P.I.B.*)

THE VETERINARIAN IN INDIA

By KARNAIL SINGH

THE value and importance of a veterinarian can be judged from the fact that two-thirds of the income of India is derived from animals. This is inspite of the solution that, as estimated by experts, 170 crores of rupees are wasted annually for the upkeep of useless livestock. Only veterinarians can improve these animals and thus can not only save this enormous sum annually but even add to it many times more by turning these useless creatures into workable ones.

Ours is an agricultural country. Agriculture and livestock go hand in hand. They are complementary and each is indispensable to the other. To promote agriculture, efficient labour-power is essential. The chief agency that supplies this motor-power is the ox. If we take away the ox or allow it to be inefficient there is no agriculture. Veterinarians have an indispensable place here.

Milk, which is nature's best, complete and thoroughly wholesome food both for children and adults, is a product of the animals. But the average milk yield of our cow is less than one seer, while it is nine seers in the case of cows of Denmark. It is shocking to know that (before the last war) the quantity of milk that we drew from 18 crores of animals was drawn from 2½ crores in Germany, 3½ crores in the U.S.A., 7½ crores in Great Britain and 7 crores in Russia. Denmark started to improve their cattle when the average milk yield of their cow was not better than the average milk yield of a milch cow in India today. Yet in less than fifty years the average yield of butter fat per cow has been raised from 88 lb. to 359 lb. per annum, i.e. more than four times. Similarly marked increases have been effected in other countries. There is no reason to believe that our cows would not be able to yield as much milk as the cows of other countries.

In spite of the fact that India has one-third of the cattle of the world, the average milk consumption per head of population is only 7 ounces, while it is 30 ounces in France, 35 in the U.S.A., 39 in Great Britain, 43 in Norway and 56 in New Zealand.

There seems to be some relation between milk consumption per head of population and the average age of man. The average longevity of an Indian with low milk consumption is 28 years, while that of the New Zealander with milk consumption of 56 ounces is about 70 years.

Infant mortality occurring in India is probably the highest. Similar relation as in the case of milk consumption and average longevity seems to exist here too. Here is the task for the veterinarian. For, he alone can help our fellow men to grow healthier with better brains and long life.

Indian sheep are of bad quality and their average live weight would be hardly sixty pounds. Their average wool yield is about 2 lb. which is very low. As against this, sheep of European countries are of superior quality, their average live weight and wool yield are about three times more than those of Indian sheep. India has six per cent of the total number of sheep of the world but produces only two per cent of the total wool of the world, that is three times less when compared with the number of sheep it has. This too is the task of the veterinarian, who by turning the sheep into as good as those of other advanced countries will supply better and more woollen clothes and more meat as well.

The same is the case with goats and poultry. They also need improvement. By improving these, the veterinarians will be able to make milk and eggs within the reach of everybody.

Let us now consider the losses that we have to meet due to some of the major contagious diseases of the animals.

There are three main contagious diseases that generally occur as epidemics. These are

rinderpest, haemorrhagic septicæmia and foot-and-mouth. These cause immense losses to India. The deaths recorded in 1926-27 due to rinderpest were 202·2 thousands, haemorrhagic septicæmia 36·4 thousands and foot-and-mouth 13·6 thousands. As a matter of fact these figures are far below the actual state of affairs. This is clearly shown by the examination of the figures from Burma, in a part of which the notification of deaths from cattle diseases was made compulsory. There it was found that if these figures were believed to be correct then the calculated average age of an animal would come to 54 years which is nothing but absurd. The average age of cattle is probably six years which is nine times less than the average age calculated in Burma. So roughly we can say that actual deaths are nine times more than those reported. Perhaps still heavier losses are sustained by the cultivator indirectly, as, in case of foot-and-mouth; for one animal that dies 99 may be temporarily incapacitated and also there is loss due to imperfect cultivation and decrease in milk too. Tnere are also other numerous known and unknown parasitic and protozoan diseases, the losses due to which also are fairly heavy. The loss due to warble-fly infestation has been estimated even on a conservative estimate to be 1½ crores of rupees annually. These diseases have been practically stamped out in European countries and there the losses due to these amount to a negligible quantity compared to the losses in India. There is no reason to believe that we should not be able to accomplish what others have. Thus we see that it is a veterinarian only who can save the country of the tremendous loss by eradicating diseases, etc.

There are a number of diseases like T.B., rabies, anthrax, undulant fever, actinomycosis, foot-and-mouth, etc. that are communicable from animals to men. There are also the so-called milk-borne diseases such as cholera, diptheria, typhoid, scarlet fever, septic sore throat, that may be transmitted through the agency of milk from one individual to another. Thus the veterinarians, by eradicating such diseases in animals and supplying scrupulously clean milk, will reduce the incidence of these in human beings too.

I think this should suffice to convince any impartial judge of the great importance of veterinarians in India. As a matter of fact the key to the prosperity of India lies in the hands of the veterinarians.

Yet we see that the veterinarians are ignored everywhere. No due regard is paid to them. They are looked down upon by the majority of the people. This is all due to the ignorance of the public who do not understand their worth. Even some veterinarians think that theirs is an odd job. They think themselves to be unfortunate ones to join this profession. But the veterinary profession is economically the most productive and its science an illuminating one. Even then veterinarians are not properly paid by the Government.

Let bygones be bygones. Let us look to the future with hope. For we have now at the helm of affairs genuine men who will pay attention to these. Up till now the most important things were the most neglected. So the veterinarians have been neglected to the utmost. Today they are so downtrodden that a veterinarian often hesitates to disclose his profession.

The reader will see from the above that most important problems confront the veterinarian. These are :

(1) Production of milk and its by-products.

(2) Improvement of cattle and the supply of bullock for agricultural purposes.

(3) Supply of meat by improving sheep and goats.

(4) Supply of wool by improving the sheep.

(5) Supply of eggs by improving poultry.

(6) Control of contagious and non-contagious diseases of animals.

(7) Eradication of diseases common to man and animals.

(8) Eradication of milk-borne diseases.

(9) Treatment of sick animals.

Besides this, the veterinarian has to supply beef and pork to persons who relish it.

These are important problems for the nation. If our country is to progress and progress soon, the most efficient and competent persons should be induced to join the veterinary profession. But unfortunately those who generally fail to find a place elsewhere join this profession. To attract efficient and competent persons, it is essential that the status of the veterinarians must be raised. I hope leaders of the nation and various *go-seva* workers will consider this subject with zeal.—Reproduced from *Harijan*, June 19, 1949.

GUR

By DEVENDRA KUMAR GUPTA

THAT face value is often deceptive is perfectly true at least in the case of jaggery or *gur*. Sugar has been able to beat jaggery out of the field not only because the modern mechanized trade was at its back but also because we believe in the 'colour bar' even in our edibles. In the beginning of sugar manufacture our country people were very sceptic about its use, they only did not know that later science will prove that they were right. Sugar is cent per cent sucrose—the sweet carbohydrate—a concentrated fuel. It supplies only calories. Dr Wilder of the Council of Foods and Nutrition, U.S.A., years ago stated that sugar was not among the recommended foods, for sugar supplies nothing but calories and what is worse is that to liberate these calories sugar saps the vitamins provided by other foods.

But *gur* is something different. It is sugar-cane juice minus much of its water. It retains all the mineral salts and other nutrients present in the juice.

	Sugar	*gur*
Sucrose ...	99·7	59·71
Glucose ...	Nil	21·28
Minerals	0·02	3·36
Moisture	0·04	8·86

Dr Kali Das Mitra of Patna states that 'Because of its mineral content however small, *gur* is a superior article of diet as compared to sugar'. The present day student of nutrition lays great stress on the presence of 'trace elements' in the diet. One analysis of *gur* furnished by the Director, Nutrition Research, Coonoor (S.I.) gives the following quantities of the four minerals which play an important role in the metabolic processes more especially calcium which is presumably present in an organic form :

Minerals	Mg. per 100 gm. of *gur*
Calcium	75 mg.
Phosphorus	38 mg.
Iron	11 mg.
Copper	56 mg.

Thus the dark colour which degrades *gur* is due to much what is good in it. The misunderstanding that it is due to impurities is wrong. This colour is mostly due to these health giving nutrients like mineral salts, etc.

You will find nearly that one-fifth of the total sugar in *gur* is in the form of glucose or fructose. It will thus be seen that injestion of *gur* possesses the advantage over that of sugar in that its glucose content saves the organ concerned the exertion required to injest the corresponding amount of sucrose injested.

Diabetes has increased tremendously in recent years and a part at any rate of this increase may be ascribed to the use of white sugar to the exclusion of *gur*. White sugar is also one of the causes of dental decay.

Experiments reports from Hawaii in 1933 show that cane molasses is a good source of vitamin B_1 and B_2 and these must be also present in *gur*. Similar is the experience of Czechoslovakia and Japan.

All this evidence and the accumulated experience of generations of the village people proves it beyond doubt that whereas the use of mill-sugar leads to exhaustion, dental decay and diseases like diabetes and anaemia, the brown jaggery of *gur* gives man the gifts of health-vitamins A, B_1, B_2, and minerals like calcium, iron and phosphorus and nutrients like carotene, glucose, fructose, proteins and fats, small though they may be.—Reproduced from *Gram Udog Patrika*, Wardha, July 1949.

Book Reviews

RURAL PROBLEMS IN MADRAS (MONOGRAPH)........

By S. Y. Krishnaswamy (Printed by the Superintendent, Government Press, Madras, 4th edition, 1947 : Rs. 5).

THIS is a volume covering 545 pages with 13 chapters, besides conclusion, 33 appendices and synopsis. There are 32 charts, diagrams and photographs devoted to diverse yet vital subjects. All problems connected with agriculture and animal husbandry and general rural economy have been dealt with in this highly fascinating and useful monograph.

Following the Conference on Rural Life in Europe under the auspices of the League of Nations the preparation of a monograph for Madras was undertaken by Sir S. V. Ramamurty, K.C.I.E., I.C.S., who has given an illuminating introduction to the book.

Although the work was initiated by Sir S. V. Ramamurty the 'work has been done by Mr. Krishnaswami' who deserves to be congratulated. The book bristles with a mass of useful information and from the agricultural standpoint a very welcome feature is an appreciation of the technical aspect and importance of science to agriculture. The reviewer has come across men even in the Agricultural Department with pessimistic views, and sometimes specialist in one line deprecating the work or utility of that of another. The attitude of men on the propaganda side towards research has not been and is not always what it should be. It is, therefore, a highly gratifying matter that the author, an I.C.S. officer, has put his finger on the right spot and has so admirably tried to impress the value of scientific aid to agriculture. His remarks, viz. that 'physical and chemical properties of soil play a dominant part' (p. 113), and the need for a scientific study of soils in relation to crop 'production cannot be over emphasized' (p. 114) are instances of a broader outlook of which India is badly in need. Mr. Krishnaswamy rightly emphasizes that 'what is required is not a mere soil study but a study in relation to crop, region by region' (p. 126).

There is so much in this monograph that a complete review will occupy a large space. The following therefore refers to the more notable features taken at random.

Out of a total population of over 49 millions in Madras, 41 millions live in villages (p. 13). The proportion of rural population to total population is 84 per cent. There are 35,430 villages in the province. Fifty years ago the total urban population was $3\frac{1}{2}$ millions; today it is nearer 8 millions. The old aggregations of village life have changed from being a unit of economics and civilization to a unit of agricultural production only. Time was (p. 15) when the culture of the country was developed in the village and received its reward in the courts of kings. The time is now when the results of studies made in urban surroundings have to be carried to the village for the benefit of the cultivator. The reviewer is in complete agreement with the author; he strongly feels that however we may desire it will be impossible to return to or revive the old order of village economy or what was once village sufficiency.

The incedence of malaria as a cause sickness, death and economic loss is so heavy as to nearly overtop the combined effects of all epidemics like cholera, plague and small-pox. Yet Madras is not certainly as malarious as some parts of Eastern India.

Infant mortality per thousand is 172 as compared to 172 for undivided India and is more than three times that of the United Kingdom. Enquiry in the districts of Madras Madura, Coimbatore and Trichinopoly showed that in groups with incomes under Rs. 25 the mortality rate was 120, under Rs. 50, 102, and over Rs. 50, 84. It is not however clear how the average (given in p. 21 and cited above) should exceed the maximum. Possibly this is a typographical error.

Out of every 1,000 persons 445 have no work. Out of the remaining 555, 270 are dependent on agriculture, 77 on industry, trade and transport, 11 on public administration and 197 on miscellaneous occupations. In 1921, 71 per cent of the population was dependent on agriculture, in 1931 it is shown

to be 50 per cent; this variation is however too wide and is due to a different system of classification.

Within agriculture out of every 1,000 persons engaged 429 are agricultural labourers, 390 are cultivating owners, 120 cultivating tenants, 34 non-cultivating owners and 16 non-cultivating tenants. The evil of absentee landlordism is not as prevalent as one would suppose. This evil persists in the rich deltaic areas.

There is an improvement in the employment afforded by minor industries connected with repairing of motor vehicles, construction and repair of roads and bridges.

By far the best cultivators are the Nayudus and Gownders. The scheduled castes, forming eight millions, are the agricultural labourers and are in larger numbers in South Arcot, Tanjore and Godavari districts. The Muslims as a whole have not impressed themselves in rural avocation except in Malabar. The Christians are relatively in large numbers in Tinnevelly and Guntur. Several missionary organizations have taken keen interest in rural reconstruction of which the Y.M.C.A. Rural Reconstruction Centre at Ramnathpuram has been said to be a standing illustration.

The coastal districts of Vizagapatam, Godavari, Tinnevelly, Malabar, Tanjore, Kistna and Madura offer avenues of emigration to Ceylon, Malay, Fiji, Trinidad and Jamaica, British Guiana, South Africa and Mauritius and emigration is quite appreciable. For instance, in Fiji out of a total of 83,289 Indian population, Madras accounted for 23,500 in 1934 coming next to the United Provinces with 50,500.

In Madras the different forms of land tenure system are the Zamindari tenure, the Ryotwari tenure, the Inams, the Malabar Land Tenures and the Muli Tenure of South Kanara. The Monograph states that 'after the Permanent Settlement the worst sufferer, however, was the ryot' (p. 38). Taking the holdings on all systems the area of cultivated land per cultivator is 5·99 acres and the average size of holding is 4·5 acres. In consequence of the laws of inheritance and pressure of population fragmentation of holding has been accentuated.

In matters of irrigation the Province has facilities to irrigate between 11 and 12 million acres with 30 canal projects, 22 reservoir projects, 33,086 tanks and 728,092 wells. One of the important irrigation works is the Grand Anicut on the Cauvery at the head of the delta. This is the oldest work in the delta built many centuries ago by the Chola kings and is an amazing tribute of wisdom and skill of the ancient engineers. The development of well irrigation has been largely due to the exemption of additional taxation on private improvements. The author has discussed the irrigation policy of Government and has rightly remarked that in a country where so much is dependent on the monsoon and where the monsoon is notoriously capricious, reorientation of the policy is needed more to affect the people beneficially than to yield larger revenue returns.

South Kanara and Malabar on the West Coast and Godavari, Kistna and Tanjore on the East Coast may be considered to be immune from famine, though in Malabar the pressure of population is reacting adversely.

Attention has already been drawn to the importance attached by the author to the technical side of and scientific aid to agriculture. With regard to phospate Madras is fortunate in having a two-million ton deposit of mineral rock phosphate in the Trichinopoly district. Stress has been rightly given on nitrogen deficiency which is a problem. The author gives an estimate of the deficit in Madras which is to the tune of 605,000 tons of nitrogen, 210,000 tons of phosphoric acid and 641,000 tons of potash (p. 121).

The country plough continues to be the main implement of cultivation. Out of 3,878,868 ploughs, 52,184 or a little over 1 per cent are iron ploughs. A number of useful implements have been devised such as the bund-former, termeric polisher, etc.

The author has struck the right note in emphasizing that the 'major problem at the moment is not so much deficiency in acreage as deficiency in yield'. We very often lose sight of the fact that in India the yield per unit area is very low. During the last 20 years the New York State acreage devoted to potato has been cut to half, yet the total tonnage produced has been doubled, in other words the yield per unit area has been quadrupled. In Britain the yield in 1943-44 as compared to 1934-38 was raised by 109 per cent in the case of wheat, 115 per cent in the case of barley, and 102 per cent in the case of potato. The yields of other crops were also raised considerably. In India we have very few instances of similar achievements.

The author is of opinion that most of the ryots are illiterate and leaflets are of no use to them. It is necessary therefore to go actually to the ryot and show him, and not wait for him to come and be told. This may be by exhibitions on all important occasions and festivals.

The major deficits for providing a balanced diet are in pulses, vegetables, fruits, milk, fats and oils and meat and fish. The deficit in pulses requires to be made up by increasing production sixfold.

Madras is fortunate in having some fine breeds of cattle but unfortunately encroachment on grazing and fodder areas for food and commercial crops is leading to their deterioration. As in other parts of India the number of cattle per 100 acres of net sown area is very high, being 69 as compared to 67, 38 and 25 respectively for India (undivided), Holland and Egypt. The Madras cultivator is more fertilizer minded and has a better cattle conscience. The supplementary feeding with a mineral mixture is now an accepted practice among advanced agriculturists.

The author points out that in the rural economy of the province no other improvement can bring about so good results in bettering the status of the farmer as the development of the livestock industry.

After dealing with agriculture and livestock the author has directed his attention to rural industries which he divides into (1) wholetime occupation, (2) those subsidiary to agriculture and (3) cottage industries. The handloom industry occupies the premier place having the largest number of looms as compared to all other provinces except Assam. The development of power textile is a definite trend. The handloom weavers of the province consume about 25 per cent of the dyes consumed in the undivided India. Hosiery, lace and embroidery, sericulture, ericulture, woollen industry, fibres from coconut, hemp, palmyra and aloe, hand-made paper making, metal industry, wood-work, boat-building, cane and rattan work, basket-making, leaf-platter making, stone carving, soapstone ware making, slate making (also slate pencil), glass bangle industry, ceramic industry, pottery, cigar manufacture, beedi manufacture, leather industry, dolls and toys making, ivory work, match industry, button industry, bee keeping, sheep breeding, etc. provide numerous avenues of occupation to the hard working population of the province.

Important suggestions and comments have been given by the author regarding these rural industries. These apply to Madras as elsewhere and indicate possibilities whereby wholesale dependence on land can be minimized.

In the chapter on 'The Financing of Agriculture and the Development of Cooperation' the author states amongst others that there are 35,837 villages whereas there are only 10,792 societies so that the remaining 25,045 villages (i.e. 70 per cent) require cooperative societies to be organized. He also presents data (p. 360) showing that a substantial portion (about 63 per cent) of rural debt is unproductive; this is a matter of anxiety. Madras has to its credit other forms of societies, such as Agricultural Improvement Societies, Land Reclamation Societies, etc.

According to the census of 1931, 16 per cent of the males and 2½ per cent of the females were literate. In 1941 the literacy per 1,000 population was recorded at 130, and the same per 1,000 females was 63. Twenty-five years ago only 1·8 per cent of the female population attended school as against 4·6 per cent in 1942. The paucity is due to the general feeling that 'marriage and motherhood is the chief, if not the only career for women and that the education of girls should be limited to this objective'. In 1932 there were 770 public libraries, the number increased to 1,340 in 1944. The number of books and journals totalled 891,389 and over 2¼ million persons made use of them as against 1¼ millions in 1932.

The living room in the houses is quite inadequate and contrary to popular impression actual congestion in some of the villages is greater than in the towns specially in the deltaic tracts. Both in towns and villages the position is lamentable in regard to the quality of houses and the area of habitable space. The author stresses that the first essential for rural housing is to undertake a comprehensive survey.

Before conclusion it may be said that that the book is replete with a mass of useful information and will serve as a guide to other provinces to undertake similar work. The aim of the book is to afford a background to those who desire to improve the economy of rural life'. We have men with vision but without facts. Similarly there are men possessed with fact but without vision. A blending of both is the first essential for success in rural improvement'. (I.C.)

STARTING AND MANAGING A FARM

By C. M. Hampson (Published by McGraw-Hill Book Company Inc., New York, pp. 244, $ 2.60).

THE book is divided into three parts. Part I is divided into five chapters and deals with what one can expect from farming. Part II, divided into five chapters, deals with part-time farming with suggestions as to how to select and manage such a farm. Part III has been divided into eight chapters and deals with a large commercial farm. This is the most important part and deals with the various kinds of large farm and methods of selecting and managing them. The interesting features of the book is that there is a summary at the end of each chapter, giving briefly the various points discussed. The material given in the book based on 35,000 farm records from 31 States is applicable to all common types of farming in all parts of the United States. It describes what kind and size of farm to have, where and when to start and how to manage it to get the greatest return. Though the data given in the book relate to farming in the U.S.A. the general principles discussed will apply equally to farming under Indian conditions. It is, therefore, commended both to the students in Agriculture and the practical farmers. (K.S.)

COVER ILLUSTRATION

Pre-monsoon
cultivation in Bombay Province

News and Views

CAN THE WORLD PRODUCE ENOUGH FOOD ?

CAN the world produce enough food to feed its maximum potential population? This question of prime importance to many countries is discussed in a pamphlet entitled *Food And The People*, published by the Bureau of Current Affairs.

Dr Aldous Huxley says that the only alternative to worldwide starvation is reduction of numbers almost everywhere. Sir John Russell, President of the British Association and one of the world's greatest authorities on agriculture, disagrees. Both viewpoints are set out in the pamphlet.

Says Dr Huxley : If " we are to avoid starvation there must be a ' world population policy ' based on birth control ". Meanwhile he calls for the resources of applied science to be mobilized for the relief of the world's hunger.

Sir John Russell agrees with the latter proposition but maintains that the world can keep pace in food production with any foreseeable increase in population.

Of all the food problems, he points out, those of India and Pakistan are probably the most difficult; yet there still remains uncultivated land in the sub-continent equal to two-thirds of the area now being farmed.

Moreover, increasing the output per man and per acre may well prove to be the real answer to the world's food problems and there is much work being done along these lines in India and Pakistan.

It is estimated, he continues, that 90 per cent of food is consumed on or near the land of its production and only some 10 per cent goes on the world market.

Should further acreage be required, however, Sir John calls attention to the fact that only some 10 per cent at the most of the world's land area is yet used for food production. There yet remain enormous areas, which, with irrigation, the use of insecticides and modern equipment, could be brought under the plough.

Britain, he considers, sets an excellent example of land utilization, the yield per acre and output per man there being already among the highest in Europe and three or four times greater than in the U.S.S.R. Britain's average yield of potatoes is about seven tons per acre, but a good farmer can easily get ten; the average milk yield in Britain is 600 gallons, but good dairy farming produces upwards of 1,000; wheat averages 19 cwt. per acre against 9·2 cwt. in Canada and the U.S.A. and 5·6 cwt. in Russia.

Another way of augmenting food supplies is by increasing the war on pests. The F.A.O. has estimated that mites, pests and rodents destroy 65 million tons of grain per year.

The conclusion seems to be that with proper management, more scientific application and better planning, the world need never starve provided that Governments work together and food production is given the priority it deserves. (*B.I.S.*)

APPLICATIONAL COURSE IN AGRICULTURAL STATISTICS

THE following students, deputed by different Departments of Provincial/State Governments, Ministries of Central Government, Institutes, etc. have passed the final examination of the Applicational Course in Agricultural Statistics conducted by the Indian Council of Agricultural Research in May, 1949.

			Division
1.	G. D. Chakrabarty	Department of Agriculture, Forests and Fisheries, West Bengal	First
2.	P. R. Yeri	Agriculture and Rural Development Department, Bombay	First
3.	R. Devarajan	Government of Cochin	First
4.	Gurdial Singh	Horticulture Department, Patiala and East Punjab States Union	Second
5.	K. N. Vali	Veterinary Department, East Punjab	Second
6.	A. G. Kavitkar	Indian Agricultural Research Institute, New Delhi	Second
7.	J. C. Victor	Animal Husbandry Department, Madras	Second
8.	M. L. Shukla	Department of Agriculture, United Provinces	Second
9.	J. S. Srivastava	Animal Husbandry Department, United Provinces	Second
10.	M. Gangarudriah	The Government of Mysore	Third
11.	K. S. Sinha	Department of Agriculture, Bihar	Third
12.	R. N. Chaturvedi	P.W.D. (Irrigation Branch), United Provinces	Third

—(I.C.A.R.)

DIPLOMA COURSE IN FRUIT AND VEGETABLE PRESERVATION

THE following students have passed the Final Examination of the Diploma Course in Fruit and Vegetable Preservation of the Indian Institute of Fruit Technology, New Delhi, of the Indian Council of Agricultural Research for the session 1948-49. The names are in order of merit and the figures within brackets represent the marks secured by a candidate.

First division

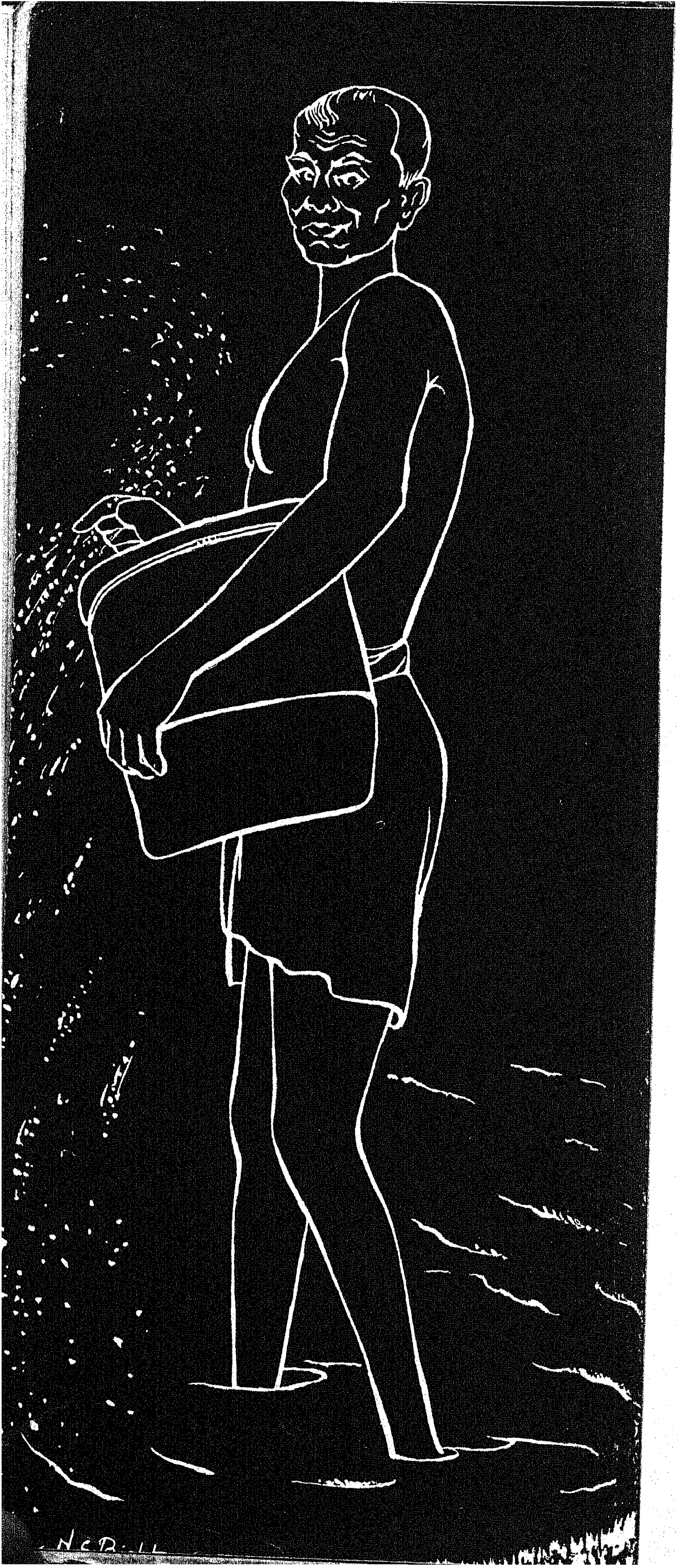
Shashikant Mehta (536); Desh Raj Sharma (492); Balkrishan Sethi (483); Dhara Singh Rana (473).

Second division

Maghar Singh (469); Dalip Singh (469); Ratan Lal Dang (464); R. D. Ghosh (460); A. C. Batra (457); K. C. Virmani (436); Vijay Pardhan (428); M. M. Mehta (425); Satwant Singh (425); H. B. Pingley (415); Sikandar Singh (408); and K. Venkateswarlu (389).

—(I.C.A.R.)

PLATE 56



Sowing the rice seed. 'Ura'
cultivator of Ranchi, Bihar

INDIAN FARMING

OCTOBER, 1949

Vol. X No. 10

COMBATING THE FOOD SHORTAGE*

I HAVE troubled you all, Hon'ble Ministers from Provinces and States and your officials

Errata for the August 1949 issue
of
Indian Farming

FRUITS FOR THE MILLIONS

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imported foodgrains. We are also spending away a large amount on shipping freight on foreign grains. The Government of India therefore decided in March last to stop the import of foodgrains and increase the production of food within the country and reach a target by 1951 which would enable us to feed the Nation at the present nutritional level without imports. To achieve this object both the deficit as well as the surplus provinces have

to play a big part. Surplus provinces like the Central Provinces, Orissa, Assam and some of
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the deficit provinces.
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e regarded as minimum
pending any further alterations. As I have said in some cases there may be a greater increase than has been proposed. It is also possible that in some cases there may have to be a reduction but one decision is definite and certain and that is that unless there is an unforeseen adverse development in a particular area, provinces and States must plan for substantial increase in local production and procurement. I hope many units will be self-supporting by 1951 and that the surplus regions will produce enough to supply the needs of such units as still remain deficit. In the vital campaign of food production and food procurement, the surplus and

*Speech delivered by Hon'ble Shri Jairamdas Daulatram, Minister for Food and Agriculture at the Food Ministers' Conference held on 1 August 1949.

deficit provinces will not, I hope, pull in opposite directions but will share the same attitude in regard to the national campaign for self-dependence. The economic interests of deficit and surplus provinces are in more than one way interconnected and inter-dependent and joint effort in the common national cause is absolutely essential.

The other event since we met last to which I have made a reference was the re-imposition of control. This was intended to fight inflation. Food is an important item in the cost of living. The cost of living of industrial labour and the urban middle class is an important matter for any country. It is therefore necessary to see how far we have succeeded in reducing the cost of food for this sector of the Nation's population. It is true that the prices of foodgrains have not reached the level of December 1947, but the prices of wheat, rice and *bajra* have fallen below the pre-control level as you will notice from the papers we have circulated. The price of *jowar* has, however, shown a reverse tendency. This is due to great shortage in production of *jowar* in the Central Provinces and the United Provinces on account of unfavourable weather conditions.

The rationed population has greatly increased since the re-imposition of control. It stood at 133 million about a month ago. This portion of the population is thus having the advantage of controlled price. Of this nearly 47·7 millions, i.e. nearly five crores constitute the urban rationed population. Thus practically all industrial labour and the urban middle class are covered by controlled ration and are getting foodgrains at materially reduced price than before re-control.

In the East Punjab, Bombay and Madras, the cost of rice for the rationed urban population has been reduced by nearly 50 per cent, though it is still very high as compared with pre-war conditions. In other provinces the percentage of fall is less, but it is still substantial except in the case of the Central Provinces where the price of rice has always been low compared with other provinces. In the case of wheat also there has been a material reduction in the price level generally for the urban population.

We have not, however, attained our objective of further reducing level of prices for foodgrains. We will be fixing the *kharif* price in October 1949 and the *rabi* grain prices about April next year. There is likelihood of a progressive fall in the world price of foodgrains, and the imported grain for the next two years will probably be available at much reduced prices. This cannot but influence our internal price of foodgrains. On the other hand, there is a demand for stabilization of agricultural prices at a reasonable level and for correlating the price to the cost of production and cost of living of the agricultural producer. There must however be a proper balancing of all relevant economic factors before reaching a final decision and that decision must be guided by the overriding consideration of placing our national economy on a sound and solid basis.

We have one other important item on the agenda relating to the methods of procurement and rationing adopted in different provinces. I would venture to suggest that greater uniformity than now exists may be secured in our systems of procurement and rationing. The experience of those provinces and States where procurement has been satisfactory is available to others and by a free exchange of views, we may try to reach a decision in regard to methods of procurement which may yield good results all round.

There are also certain proposals before the Conference with regard to the extent of rationing to be aimed at. It has been suggested that if Government undertakes responsibility for a smaller sector of the population but supplies it with a larger ration, it might lead to better controlled prices and provide for more effective enforcement of food laws. I feel the question of uniformity of procurement and change in the rationing arrangements important enough for a Committee being appointed to make recommendations.

There are other items on the agenda to which I may briefly refer. More than one country has made up its food deficit by introducing the subsidiary foods in the national diet and since from the yield and nutritional point of view everything can be said in their favour, it is essential that the Provincial Governments should plan for increased production of the subsidiary foods and work out arrangements by which they can be adequately introduced in the diet of the urban population. The Subsidiary Foods Committee of the Food Ministry has prepared a big programme in which the cooperation of the Provincial Governments is invited.

As you all know, our Prime Minister in his broadcast on food about a month ago

emphasized the importance of reducing the consumption of rice with a view to reduce the heavy imports of rice from abroad for which we have to pay much higher rates than for wheat. There will be substantial saving if the use of wheat is popularized in place of rice. We would like to have your advice as to how this can be best achieved and also how such difficulties as some of you may apprehend can best be overcome. There is also the question of use of unpolished rice. I know that the distribution of this rice has led to a certain measure of unpopularity of the rationing system. We are considering measures for avoiding polished rice and giving to the people under-polished rice. This change requires the working out of technical details with regard to the milling operations, and it is proposed to secure full information as to the methods of milling in each province and State and determine in what manner they can be adjusted to secure the results we have in view. If the programme of self-sufficiency is to succeed, we must adopt all methods to save as much food as possible. The tightening of the austerity measures must be fully considered and all waste avoided. So also it is necessary to go more thoroughly than has been done hitherto into the question of quality of foodgrains issued from the ration shops. There have been widespread complaints that bad quality of grain is being served to the people. It is essential to keep a continuous check on the quality of imported foodgrains from the time of unloading of the steamers till it is issued from the ration shops to the consumer. We propose with your cooperation to take up this matter systematically and revise and extend the existing arrangements for maintaining the quality of the foodgrains.

There is also the last item on the agenda relating to the need for greater publicity in regard to food matters. All our programmes of self-sufficiency, better procurement and more satisfactory distribution need special and adequate publicity. I would suggest that all the last five items on our agenda, i.e. those relating to ban on polished rice, reduction of rice consumption, austerity measures, control of quality of grains and publicity might be referred to a Committee of officials to give us their report as to what steps can be taken in regard to these.

In the end, I may express the hope that at this Conference we will be as informal in our discussions as possible and will dispose of our whole agenda satisfactorily.

ARAB STUDS TO IMPROVE AUSTRALIAN FARM HORSES

THE New South Wales Department of Agriculture hopes to improve the standard of stock horses and of show horse types by the establishment of two Arab thoroughbred studs, one at the Wagga Agricultural College and the second at the Yanco experimental farm.

A complete stud of Arab mares, one of the most outstanding in Australia, has been bought and is being moved to Wagga. The stallion for this stud is said to be one of the best Arabs exported from Britain. Location of the stud at the Wagga Agricultural College will enable students there to study the breeding of Arab strains at first hand.—*Australian Agricultural Newsletter*, No. AGN/262.

Original Articles

THE CONTROL OF GRASSHOPPER PESTS OF CEREAL CROPS

By HEM SINGH PRUTHI

AMONG the pests of paddy, millets, etc. grasshoppers are very important. At irregular intervals serious outbreaks of these pests occur over large areas and the losses are indeed very high; for example, in 1947 the whole of the rice area in Belgaum district of Bombay Province was infested with the Rice-grasshopper and the yield in some parts fell below five per cent. Even during the years which are not marked by outbreaks, the losses due to them are sufficient to class them as major pests. Grasshoppers are important all over the world. During the ten-year period of 1936-46, the damage to crops by grasshoppers in the U.S.A. is estimated at about Rs. 250 crores. In Australia the damage is in about the same proportion. The damage is much more in India because our Agriculture and Plant Protection Organizations are yet not as well-developed as in those countries.

The grasshoppers which greatly damage the cereal crops in India are: (i) Rice-grasshopper, (ii) *Phadka* and (iii) the Deccan Wingless-grasshopper. Very often, associated with the Rice-grasshopper is the allied species *H. oryzivorus*, Bal. Of these, the Rice-grasshopper is common in the more moist areas and infests mainly paddy and sometimes sugarcane. On the other hand, *Phadka* and the Deccan Wingless-grasshoppers are confined to the drier areas and devastate rain-fed crops like maize, *jowar*, *bajra* and small millets.

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Life-history of the grasshoppers in general

All the three grasshoppers have some common features in their life-histories. The eggs are laid in the soil in clusters or pods, some time before the setting in of the winter season. They lie there till after the break of the monsoon rains in the following year. When the soil becomes sufficiently moist, development inside the eggs proceeds quickly and in 10 to 15 days' time, the tiny hoppers emerge from the eggs and wriggle out to the surface of the soil. Soon feeding becomes their main pre-occupation. As they grow, they cast off their outer skin, which they do six to eight times, till in seven to nine weeks they become full-grown. Some more time passes before they become sexually mature and then, after mating, the females begin to lay eggs. Each female may lay egg clusters two to four times in her life-time and each cluster may consist of 30 to 75 elongate eggs. All these species of grasshoppers have only one generation in the year. The winter and the pre-monsoon parts of the following year are passed in the egg-stage as described above and practically there are no hoppers at that time of the year.

Grasshoppers start feeding soon after the emergence from eggs and continue doing so till their death. They start feeding on young leaves of paddy, maize, *jowar*, etc. reducing them to skeleton and then they attack the young ears and cobs and thus damage the crops. A more detailed account of the various grasshoppers is given below.

The Rice-grasshopper

The Rice-grasshopper (*Hieroglyphus banian*) is a serious pest of paddy in many parts of India, especially in Madras, Mysore, Bombay,

FIG. 1. Egg

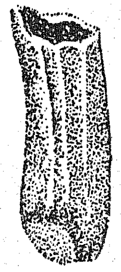

FIG. 2. Egg clusters

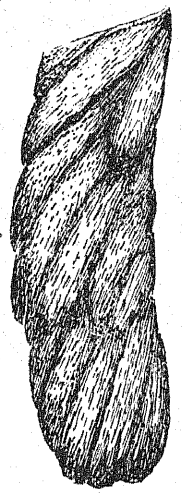

FIG. 3. Eggs in pod exposed

FIG. 4. Hopper—first stage

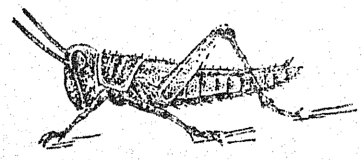

FIG. 5. Hopper—middle stage

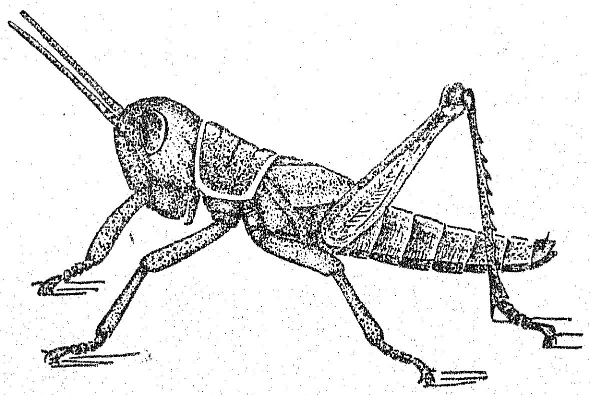

FIG. 6. Hopper—advanced stage

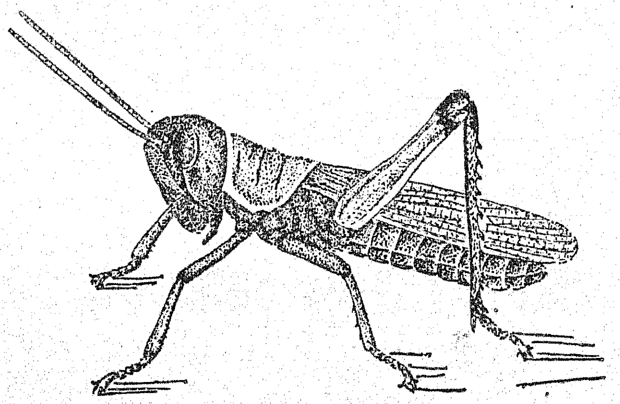

FIG. 7. Adult

RICE GRASSHOPPER
(*Hieroglyphus banian*)

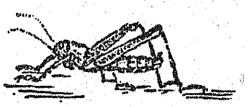

FIG. 8. Hopper—first stage

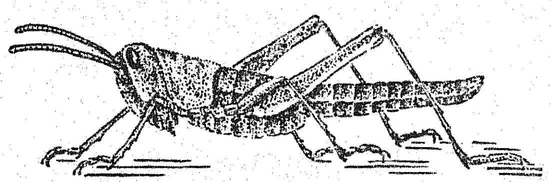

FIG. 9. Hopper—middle stage

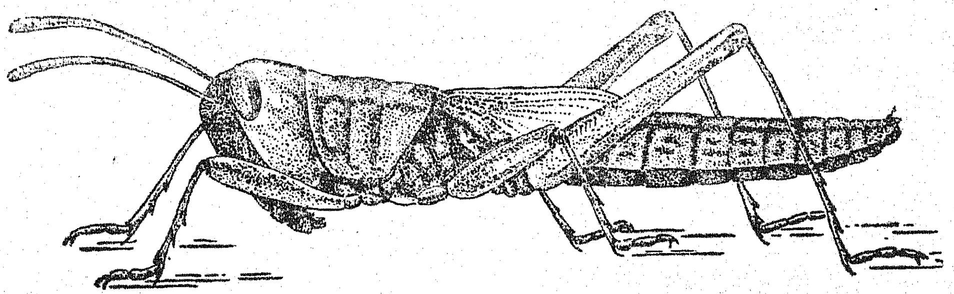

FIG. 10. Adult—male, short-winged

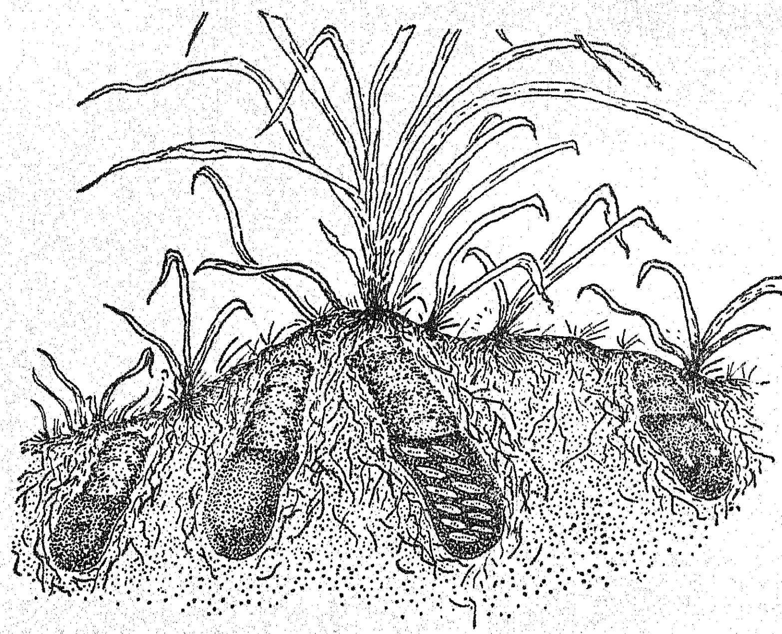

FIG. 11. Egg-pods laid at the base of bushes

PHADKA

(*H. nigrorepletus*)

the United Provinces, the Central Provinces and Orissa. Although paddy is its favourite food crop, it is known to attack sugarcane, maize, *jowar* and *bajra* also.

It is greenish in colour and is just over two inches long (Fig. 7). The male is smaller than the female. The egg clusters or pods (Fig. 2) are laid mostly along the field bunds. They are very tough and firm and are admirably suited for the long period of hard conditions through which the eggs remain viable till the following monsoon. The egg is yellowish in colour, slightly curved and about 5 mm. long (Fig. 1).

There is considerable variation in the time of hatching, depending on rains in different provinces. The earliest hatching is about the middle of June and the latest in first week of August. On emergence, the grasshopper is almost white in colour, which however, gradually changes into dark yellowish brown (Fig. 1). To reach the adult (winged) stage, the Rice-grasshopper has to pass through six or seven stages (Figs. 4, 5, 6) of various durations, the hoppers becoming adult and acquiring wings in two to three months.

By the beginning of October a fair number becomes adult and in November practically no hoppers are to be found. The adults are fully winged (Fig. 7) but they are poor fliers. Consequently the eggs are generally laid in the bunds of the area in which they had been feeding during the summer and monsoon season.

Phadka *Hieroglyphus nigrorepletus*

Unlike the Rice-grasshopper, *Phadka* prospers in drier areas and occurs in Bombay and Madras Provinces, the Central Provinces, Bihar, the United Provinces, Ajmer-Merwara and the adjoining States. It lives on grasses in general and is a pest of maize, *jowar* and *bajra* in particular. It has gained notoriety as a pest only in recent years, having been observed as such in Nellore (Madras) in 1937, in Sind (near Karachi) in 1940 and since 1946 it has come into prominence and progressively been causing extensive damage to the *kharif* crops in Ajmer-Merwara and lately in Udaipur, Kishangarh and Jodhpur Divisions of Rajasthan.

In its early stages *Phadka* feeds on the grasses growing on the field bunds, etc. Later, when the crop comes up, it moves to crops in the fields. When the crop is still young the hoppers feed vigorously on the leaves but as the ears are developed they prefer the tender juicy grains in them. They also get into and live in the leaf whorls. There their faecal matter accumulates, rots and creates a condition congenial for fungal growth. The plant becomes distasteful to the cattle and is lost to cultivators even as fodder.

As in the case of the Rice-grasshopper, *Phadka* passes the winter and pre-monsoon period in the egg stage. As a rule, the field proper is avoided for egg-laying and the female lays eggs on the sides of the bunds and other patches of raised ground (Fig. 11) such as exist around the bushes and the trees. The egg pods are more tough than those of the Rice-grasshopper.

After a good shower of rain in the month of July, the emergence of hoppers (Fig. 8) continues for about a month and they begin to attain the adult stage early in September. Barring a very small percentage, the adults are short-winged (Fig. 10). These dwarfed wings are only helpful to the insect in long jumps rather than actual flight. The pest therefore occurs year by year in the same locality which affords an opportunity for a pre-planned concentrated action such as is not possible in the case of the pests which have a migratory habit or are active fliers.

The Deccan Wingless-grasshopper

This grasshopper (*Colemania phenaroides*) differs from others in having wings reduced to small pads. Like *Phadka* it is common in areas having low rainfall. It is reported as pest mainly in the Deccan upland areas, and is found in Bombay Province from Ahmednagar down to Dharwar, in Chittaldroog and Shimoga districts in Mysore, in Bellary and Kurnool districts of Madras and in the Western Deccan districts of Hyderabad. It feeds mainly on *jowar*, *bajra* and other small millets but sometimes also damages wheat and the flowers and pods of pulses and other legumes.

The wingless adult is marked in vivid blue, green and red and is 1·5 to 2 inches long, the male being markedly smaller than the female. The eggs are laid in pods in the autumn at a depth of two to three inches in the soil, most often among the roots at the base of *jowar* and *bajra* plants and of the bushes on the field bunds, etc. They remain in the soil till next June, when following the fall of first heavy

shower of the monsoon they develop and hatch into small hoppers. These, after passing through five stages of growth (Figs. 12, 13, 14) become the adult when they have well-marked wing pads or rudiments only (Fig. 15).

Not infrequently the millet crop is attacked and devastated when only the first one or two leaves have appeared. If the infestation is heavy even a full-grown crop is completely defoliated and one only finds the mere mid-ribs of the leaves emerging from the stubbles. When the ear heads appear, the tender grain in them is the first to be eaten away by the pest.

Control of grasshoppers

Till recently the chief methods of control of various grasshoppers comprised of (a) destruction of the eggs by ploughing the egg-laid area or scraping of a few inches of the soil along with the egg-pods, (b) poison-baiting of the hoppers and the adults, and (c) trapping them in hopperdozers or tin sheets besmeared with a sticky substance, such as coal-tar. With the discovery of some synthetic insecticides, such as benzene hexachloride, during the last war, we have now methods more effective and suitable for large scale operation such as we need when the infestation is really extensive.

Baiting

Mixing of a poison with a suitable food material to serve as a bait for the hoppers or dusting a poison over the tender bodies of young hoppers for killing them are the two equally important methods. It is important to emphasize at once that the use of either of these methods is far more effective when the young grasshoppers are still concentrated along the bunds than after they have grown in size and are dispersed over the entire field. Fighting grasshoppers before they attack or at the time when they first invade crop is most essential for ensuring the success of the control operations. This is particularly true in the case of baiting operations which invariably should be restricted to the early stages when the pest is on the bunds or on the fringes of the crop. The composition of the bait to be effective against the pest and at the same time remaining practically harmless to human beings and the cattle is :

Bran	50 seers
Sodium fluosilicate	1 seer
Molasses or salt ...	1 seer
Water	as required

As to the preparation of the bait, bran and sodium fluosilicate should be mixed intimately in the dry state. Molasses or salt should be dissolved in a small quantity of water and mixed in the bran and poison mixture. The quantity of water to be added should be just enough to make the bait moist but not so wet as to form lumps.

In the case of the Rice-grasshopper and *Phadka* the use of the bait is possible only when the hoppers are yet young and concentrated on the bund or in the grass land. Once they concentrate in the field, bait is of little avail. In the case of the Rice-grasshopper the condition of the field (water or mud) makes baiting inside the field unpractical, and in the case of *Phadka* the bait spread out on the field remains untouched because the grasshoppers remain always on the plants themselves. However, in the case of Deccan Wingless grasshopper, since the pest first appears in the fields themselves when the crop is almost in the germinating stage, baiting is required and is practicable both in the field and around on the bunds, etc.

Dusting

Whereas baiting can only be adopted advantageously when the hoppers are yet young before they concentrate in the field, control by poison dusting is practicable throughout the season. Of course, it is economical and easier to deal with the pest in earlier stages.

A suitable dust such as chalk charged with benzene hexachloride (BHC) in the form of proprietary insecticides such as Gammexane, Hexyclan, etc. have been found to be very effective. These proprietary preparations differ from one another mainly in the composition of the carrier or base, the active agent or poison being the same. Therefore there is not much to choose between the two. However, the three grasshoppers under consideration are not affected by the poison equally. The Rice-grasshopper is more susceptible, and is easily killed by the dust containing five per cent benzene hexachloride. As regards the *Phadka* and the Deccan grasshopper, this strength is effective only in the very early hopper stages and when the hoppers are bigger the strength of BHC has to be increased to seven per cent. To be on the safe side, it will be useful to use seven per cent benzene hexachloride throughout the operation. The amount of

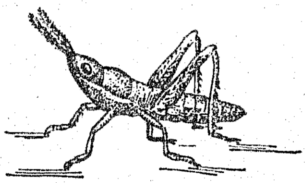

FIG. 12. Hopper—first stage.

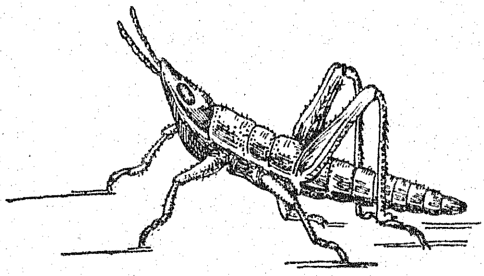

FIG. 13. Hopper—middle stage

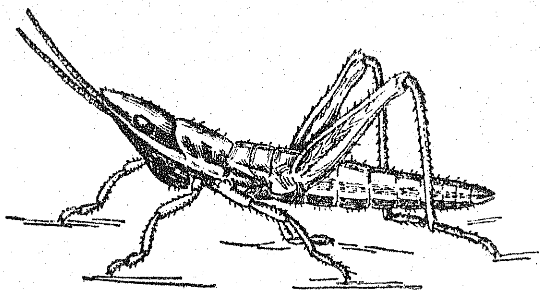

FIG. 14. Hopper—advanced stage

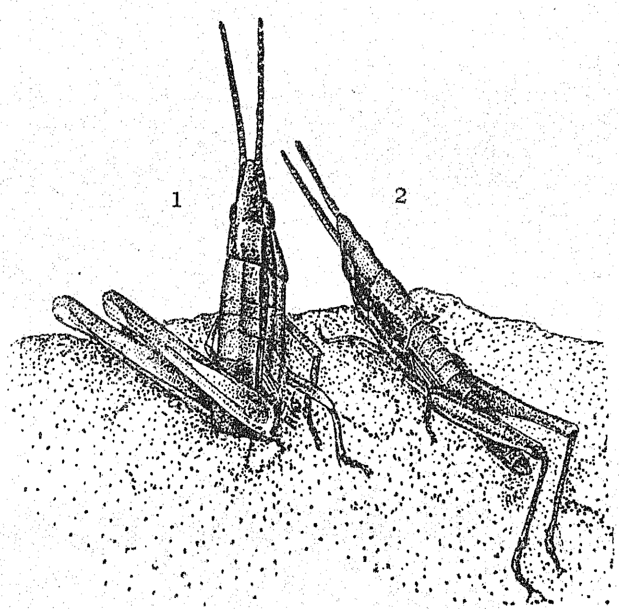

FIG. 15. (1) Female laying eggs
(2) Male

DECCAN WINGLESS

(*Colemania phenaroides*)

dust required per acre depends on the state of the crop. The more developed and dense is the crop the larger is the quantity of poison dust that will be needed. Thus the quantity of the poison dust required varies from 10 to 20 lb. per acre.

Grasshoppers do not die immediately after they have been dusted. The poison may require 10 to 18 hours to become fully effective. But that the poison is going to be effective can be seen even after an hour. It usually makes grasshoppers sick within that short period and so they stop feeding after having received a fatal share of the dust.

It should be emphasized that, contrary to a widespread impression, the crop is safe as cattle food after 36 hours of treatment.

A word regarding cooperation among the cultivators is necessary. When the breeding is isolated and the grasshoppers emerge on a particular field, the individual action on the part of the cultivator concerned may be sufficient. But during the period of the outbreak, the hoppers emerge in such numbers that they are likely to move from one farm to another. In such cases the village should be a unit and the individuals should look to the interest of the entire village. The whole area should be systematically dusted. It is to nobody's advantage to be selfish, for a single treated field in the midst of an infested area is bound to get infestation again.

RAILWAY LANDS FOR FOOD CROPS

IN view of the importance and urgency of the problem of food production, large plots of railway lands at present growing grass, are to be utilized for growing food crops. Subject to certain conditions, the Railway authorities are reported to be willing to lease these lands to Provincial Governments on the payment of a lump sum of money. The Central Ministry of Agriculture has requested the Railway Board to prepare a list of such railway lands and supply it to the Governments of the areas concerned.

Provincial and State Governments have also been asked to undertake surveys of such suitable plots, and negotiate for getting them on lease for a reasonable period. The practice in some provinces has been for the railway to auction the lands to a few contractors who in turn lease them out to the cultivators of the villages through which the railway passes.

PLANT INTRODUCTION REPORTER—I

By B. P. PAL and H. B. SINGH

THE importance of plant introduction and exploration is well known. It is as the result of introduction of new plants from one country to another that we now see such a wide variety of food, fodder and other economic plants in almost every country. It is a striking fact that until comparatively recent times the Eastern and the Western Hemispheres had few cultivated plants in common. In agriculturally advanced countries like the United States of America, plant introduction work is controlled by properly organized Bureaux of Plant Introduction and Exploration and immense benefits have resulted from the work of such Bureaux. Much of the improvement that has taken place in the crop varieties grown in the United States of America during the past 50 years or so, can probably be traced to the valuable contributions made by their efficient plant introduction service. To cite a few classical examples of successful plant introduction, mention may be made of the introduction of rubber to the Far East from the Amazon region, sugarcane from the East to the West Indies, potatoes from South America into Europe, cinchona from South America into the East Indies, and groundnuts from Brazil into Africa and India.

Plant exploration

The rapid advances in plant breeding techniques have resulted in the evolution of superior strains of crop plants and differentiation of ecotypes suitable for cultivation under a wide range of climatic conditions. The introduction of such materials from one country to another and their evaluation and utilization in breeding form one of the important methods of plant breeding. During the last two decades or so plant breeders and geneticists have come to realize that greater possibilities in breeding could be realized through the use of new and useful genes possessed by closely-related wild relations of cultivated plants. Therefore plant exploration forms an important function of plant introduction organization. The utilization of a wild species of *Saccharum* in the evolution of improved strains of sugarcane is an outstanding example of the utility of wild relations of crop plants. Potato breeding has been revolutionized by the discovery in South America of disease-resistant wild potatoes.

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Plant introduction in India

In India plant introduction has been on the whole rather slow and haphazard. The Botanical Survey of India, the Royal Botanic Gardens, Sibpur, the Lloyd Botanic Garden, Darjeeling, and other bodies and individuals introduced some useful plant material, mostly however of non-agricultural importance. With the establishment of the Agriculture Departments in the early years of the twentieth century scattered attempts have been made by these departments for the introduction of plant material of agricultural importance.

The desirability of having an organization similar to the one in America or the U.S.S.R. was stressed by the Crops and Soils Wing of the Board of Agriculture and Animal Husbandry in India, which met in 1935. The need for such a Bureau for India was reiterated at the meeting of the Board of Agriculture in 1941 when the subject 'New Economic Crops' was discussed. In 1944 at the request of the Indian Council of Agricultural Research, the Division of Botany of the Indian Agricultural Research Institute submitted a small scheme for the establishment of a nucleus organization for the introduction of new economic plants pending the setting up of a full-fledged Bureau. This scheme was sanctioned for a period of five years from April, 1946.

Since the start of this small scheme efforts to import useful plant material particularly of agricultural importance from various countries have been continuing and satisfactory progress is being made. A limited amount of plant exploitation work has also been in progress,

small areas within the country have been surveyed and useful plant material collected, studied and maintained as far as possible. As a result of this a collection of useful indigenous and exotic material has been built up seeds of some of which are available in limited quantities for trial and use by workers outside. A list of such material is given below. It is proposed to publish periodically lists of plant materials imported or collected from within the country indicating those of which seeds can be supplied. These lists are expected to be of value to plant breeders and others in this country concerned with crop plants, medicinal plants, soil-conservation plants, etc.

The introductions listed and in some cases briefly described in this report represent varieties and strains of cereals, pulses, oil-yielding plants, fibre-producing plants, fodder and forage grasses and legumes, plants useful for soil conservation, vegetables, medicinal plants and also wild relatives of cultivated plants. The list simply records the receipt of seeds of possible value and does not attempt to assess their usefulness for various purposes or for different areas; such work is however in hand and notes will be published from time to time as data become available. The names of species and varieties mentioned are those under which the seeds are received. Not all of these have been finally checked for their botanical identity. The indigenous plants have been listed separately in this catalogue. The plants of which small quantities of seeds or other planting materials are immediately available for distribution have been indicated by an asterisk mark. The double asterisk mark indicates that the material has been sent to provinces for trial. 'E.C.' numbers refer to accession numbers for the exotic collection.

Illustrations of some of the plants grown in the plant introduction plots at Delhi have also been incorporated.

Acknowledgment

The writers are indebted to Dr J. N. Mukherjee, Director of the Institute, for his great interest and encouragement in the project and the useful suggestions he has made from time to time.

Exotic collections

Cereals

Wheat (*Triticum vulgare*) (Gramineae)

E.C. 257-261: Celebration, Charter, Gabo, Kendee, Yalta. From Temora Experimental Farm, Sydney, Australia.

E.C. 313-317: Plantakof, Nostrano, MC 245, 56/96, Huron. From Swiss Experiment Station for Agriculture, Sweden.

E.C. 346: Diadem; Department of Agriculture, Victoria, Australia.

E.C. 347: Gabo, Sydney University, Australia.

E.C. 366-374: Warigo, Hofed, Fedweb, Gabo, Ridley, Javelin, Bencubbin, Seewari, Ranee. Waite Agricultural Research Institute, Adelaide, South Australia.

E.C. 375-407: Recent rust-resistant selections. From Senior Plant Breeder, Kenya.

E.C. 408-412: Shinchunaga, Norin No. 4, Norin 52, Igachikago, Saidamakomugi 27. From Japan, through the Indian Council of Agricultural Research.

E.C. 414-439: Selections from various complex crosses for rust resistance. From Mr. Mcfadden, U.S.A., through S. Labh Singh, Director of Agriculture, Jaipur.

E.C. 464 and 465: N. 150, Hy 423, I5, CCC. Senior Agricultural Botanist, Government Farm, Acre, Palestine.

E.C. 472: Saunders. Central Experimental Farm, Ottawa, Canada.

E.C. 473-477: Charter, Yalta, Celebration, Kendee. Sydney University, Australia.

E.C. 507-511: From Taiwan Agricultural Research Institute, Taiwan, Formosa.

E.C. 574-646: From Argentina. Through Mr. S. Percy Lancaster, Secretary, The Agri-Horticulture Society of India, Calcutta.

C.E. 715: Cascade. From Canada.

E.C. 729**: A drought-resistant variety from Kabul. Through the Indian Council of Agricultural Research.

E.C. 730-735: Mida, Cadet, Thatcher, Pilot, Pawnee, Comanche. From United States Department of Agriculture, through Dr Taylor of the American Embassy, New Delhi.

E.C. 796-803 and E.C. 835-838: Rust-resistant wheats from U.S.A. through Mr. Boshi Sen, Almora.

E.C. 843-848: Coronation, Floreana, Trintecindo, Florestana, Kenia No. 2, Rio Negro. From Institute of Agronomy, Brazil.

Triticum spelta

E.C. 318 and 319: Winter and summer varieties respectively. From Swiss Experiment Station for Agriculture, Zürich.

Barley (*Hordeum vulgare*)

E.C. 262-270: Coast, Bolivia, Weider, Chevron, Iredell, Wintex, Barbless. From U.S.A.

E.C. 273, 284 and 279-284: Chevron, Lico, Brandon, Mars, Peatland, C.I. 1111, Kindred, Olson M41—1522. From Colorado and Minnesota Agricultural Experiment Stations, U.S.A.

E.C. 275-278: High malting barleys from Saskatchewan, Canada.

E.C. 294 and 295: Glacier, Compana. From Montana Agricultural Experiment Station, U.S.A.

E.C. 345: Maltworthy. From Agricultural College, Roseworthy, South Australia.

E.C. 468-471: From Government Farm, Acre, Palestine.

E.C. 512-513: Tainang Native, Tainang No. 2. From Agricultural Research Institute, Taiwan, Formosa.

E.C. 815-834: B.6 (Virginia hooded), B.10, B.13, B.17, B.19, B.30, B.31, B.42 (Manchuria Selection), B.46 (Cape), B.49 (Kinwar), B.55 (Golden Grain), Princess, Gold Thorpe, Tunis, Gatama, Roseworthy Oregon, Squarehead, Cape. From Sydney University, Australia.

Oat (*Avena* spp.)

E.C. 514-516: From Taiwan Agricultural Research Institute, Formosa.

E.C. 736-740: Pama, Fulton, Boone, Mapion, Control. From U.S.A., through Dr Taylor of the American Embassy, New Delhi.

Rice (*Oryza sativa*)

E.C. 312**: New kind. From Russia received through the Indian Council of Agricultural Research. Said to be suitable for growing on steep lands.

E.C. 497-506**: From Taiwan Agricultural Research Institute, Formosa.

Maize (*Zea mays*)

A number of commercial varieties, inbreds and single and double crosses from U.S.A., South Africa, and Australia. These form part of the material of the scheme for the improvement of maize crop in India working, at the Indian Agricultural Research Institutute, New Delhi.

Pulses

Soybean (*Glycine max*) (Papilionaceae)

E.C. 324-331: Green, yellow, brown, black and variegated varieties. From China.

E.C. 440: From Director of Plant Industry, Philippines.

E.C. 745* and 746*: Earlyana and Lincoln. From U.S.A., through Dr Taylor, American Embassy, New Delhi.

Indian vetch (*khesari*) (*Lathyrus sativus*) (Papilionaceae)

E.C. 4* and 5*: White-seeded, brown-seeded. Large bold seeds rather late maturing. From Australia, through Dr W. Burns formerly Agricultural Commissioner with the Government of India.

E.C. 413*: From Iran. Probably wild. Received for seed identification.

Peas (*Pisum sativum*) (Papilionaceae)

E.C. 442*: Chinese. From Director of Plant Industry, Philippines.

E.C. 794*: Notts Excelsior. Harvey Seed Co., New York.

Green gram (*mung*) (*Phaseolus aureus*) (Papilionaceae)

E.C. 443: Native. From Director of Plant Industry, Philippines.

Phaseolus calcaratus

E.C. 776: From Economic Botanist, Burma.

Oil-yielding plant

Linseed (*Linum usitatissimum*) (Linaceae)

E.C. 519-573: 54 varieties from Argentina. Received through Mr. S. Percy Lancaster, Secretary, The Agri-Horticultural Society of India, Calcutta.

Flax (*Linum usitatissimum*)

E.C. 256*: Wada. From Western Australia. Rust-resistant.

Safflower (*Carthamus tinctorius*) (Compositae)

E.C. 647-653: Seven selections from Research Agronomist, Nebraska, U.S.A.

Castor (*Ricinus communis*) (Euphorbiaceae)

E.C. 285-286 **: Two varieties from Italy. Received through Dr P. S. Hudson, Director, Commonwealth Agricultural Bureau.

Sunflower (*Helianthus annuus*) (Compositae)

E.C. 722*: Short Early Russian. From Montana Agricultural Experiment Station, U.S.A.

E.C. 812-814**: High oil-yielding varieties from Australia brought by S. Datar Singh, Vice-Chairman, Indian Council of Agricultural Research.

E.C. 883-886: Jupiter, Russian, Mars, Pole Star. From College of Agriculture, Potchefstroom, South Africa.

Fibre-yielding plants

Cotton (*Gossypium* spp.) (Malvaceae)

E.C. 450-452: White Native, Kapas Purao Native, Ferguson (U.S.A.). From Director of Plant Industry, Philippines.

China jute (*Abutilon avicennae*) (Malvaceae)
E.C. 320*-321 : From China.
Aramina (*Urena lobata*) (Malvaceae)
E.C. 849 : Guaxima. Instituto Agronomico Seccao De Introducao De Plantas Compainas S. Paulo, Brazil.
Phormium (*Phormium tenax*)
E.C. 779 : From Auckland University, New Zealand.

Narcotics

Tobacco (*Nicotiana tabacum*) (Solanaceae)
E.C. 459-461 : Gold Dollar, Cash, Simnata. From Director of Plant Industry, Philippines.
E.C. 743-744 : Shade wrapper, Conn. 15. From U.S.A., through Dr Taylor of American Embassy, New Delhi.

Vegetables and root crops

Chinese cabbage (*Brassica chinensis*) (Crucifereae)
E.C. 289* : Chihli. From Philadelphia, through Mr. Dickson, American Embassy, New Delhi. A useful leafy vegetable giving high yield of tender leaves throughout winter. Fig. 2 shows a crop grown in the Division of Botany, Indian Agricultural Research Institute.
E.C. 163* : Petsai. From China. Like the above in growth but characterized by dark green rather thick leaves with thick midribs.
Spinach (*Spinacia oleracea*) (Chenopodiaceae)
E.C. 183* : A prickly-seeded variety. From China. Produces leaves of excellent cooking quality.
Radish (*Raphanus sativus*) (Crucifereae)
E.C. 171*-173* and E.C. 351*-358* : From China. Early and late varieties. Round or oblong shapes. Roots of one of the varieties E.C. 351A are pinkish from inside, these are less pungent and good flavoured.
Onion (*Allium cepa*) (Liliaceae)
E.C. 441* : Bermuda Yellow. From Director of Plant Industry, Philippines. Produces non-pungent bulbs of average size.
Malva crispa (Malvaceae)
E.C. 197* : From China. Appears worth trying as a new culinary herb.
Beans (Papilionaceae)
Yam bean (*Pachyrrhizus erosus*)
E.C. 340* : From China.
Goa bean (*Psophocarpus tetragonolobus*)
E.C. 456 : From the Director of Plant Industry, Philippines.
Lima bean (*Phaseolus lunatus*)
E.C. 775 : From Economic Botanist, Burma.
E.C. 760* : Fordhook. From U.S.A., through Mr. Boshi Sen, Almora. Appears to be suitable for Delhi conditions.
French bean (*Phaseolus vulgaris*)
E.C. 761 : Rival bush bean. From U.S.A., through Mr. Boshi Sen, Almora.
Sword bean (*Canavalia ensiformis*)
E.C. 333*: A bush variety from China.
Tomato (*Lycopersicon esculentum*) (Solanaceae)
E.C. 251*: Turrialba. From Costa Rica, through Dr B. B. Mundkur, formerly Second Mycologist, Indian Agricultural Research Institute.
E.C. 287 *: Rutgers. From Philadelphia, through Mr. Dickson, American Embassy, New Delhi.
E.C. 447*-449* : Native, Pearson, Marglobe. From Director, Plant Industry, Philippines.
E.C. 842 : Morden. Agricultural Experiment Station, Morden, Canada.
E.C. 788 : Ponderosa. Harvey Seed Co., New York.
Okra (*bhendi*) (*Hibiscus esculentus*) (Malvaceae)
E.C. 759 : Green Velvet. From U.S.A., through Mr. Boshi Sen, Almora. A variety without ridges on the fruit which does not dehisce on maturity.
E.C. 784-787 : Crimson Spineless, Louisiana Spineless Velvet, Hastings Dwarf Green, Perkins Mammoth. From South Carolina, U.S.A.
Sweet potato (*Ipomoea batatus*) (Convolvulaceae)
E.C. 712-714 : F.A. No. 17, F.A. No. 31, Native Tei Shin-Tun. From Taiwan Agricultural Research Institute, Taiwan, Formosa. The last-mentioned variety did well at Delhi (Fig. 4).
E.C. 764-771 : Big Stem Jersey, Triumph, Ranger, B-219, F.B. 4004, Pelican Processor, B. 4306, Unit 1, Puerto Rico. From U.S.A., through Mr. Boshi Sen, Almora. Varieties B-219, Pelican Processor and B. 4306 did well at Delhi.
E.C. 905-917 : 13 varieties from South Africa (Division of Horticulture, Pretoria).
Sponge gourd (*Luffa cylindrica*) (Cucurbitaceae)
E.C. 178*: White-seeded and large-fruited variety from China.

Fodder and forage grasses

Giant Star grasses
E.C. 1* : *Cynodon plectostachyum*. Seeds obtained from the Royal Botanic Garden, Kew. Pasture and hay, also for soil conservation.

FIG. 1 (Above). Tapioca (*Manihot utilissima*)—the valued root crop of west coast districts. Seven months old plants of Travancore varieties grown at Delhi

FIG. 2 (Below). A view of the crop of Chinese cabbage (*Brassica chinensis*). A useful leafy vegetable giving high yield of tender leaves

PLATE 57

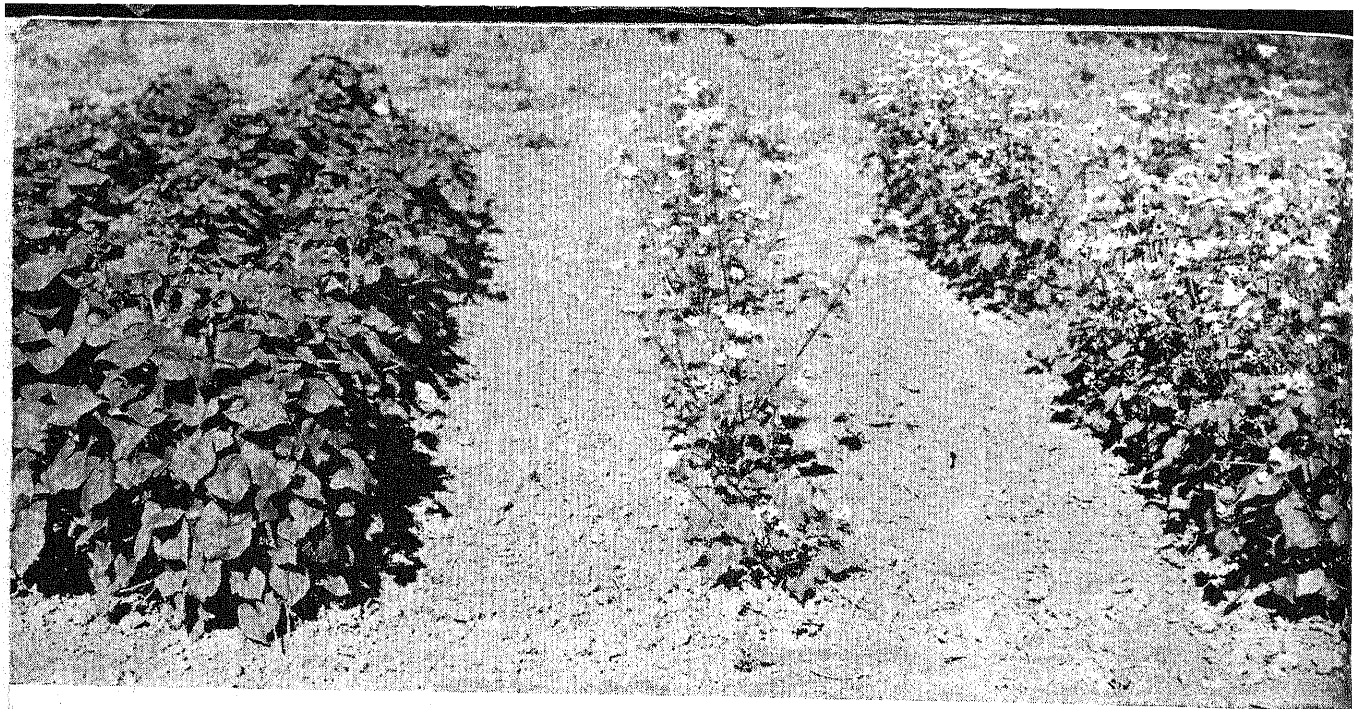


FIG. 3. Buckwheat (*Fagopyrum esculentum*). On the left is the Darjeeling variety (late) and on the right are Chinese varieties which are early maturing

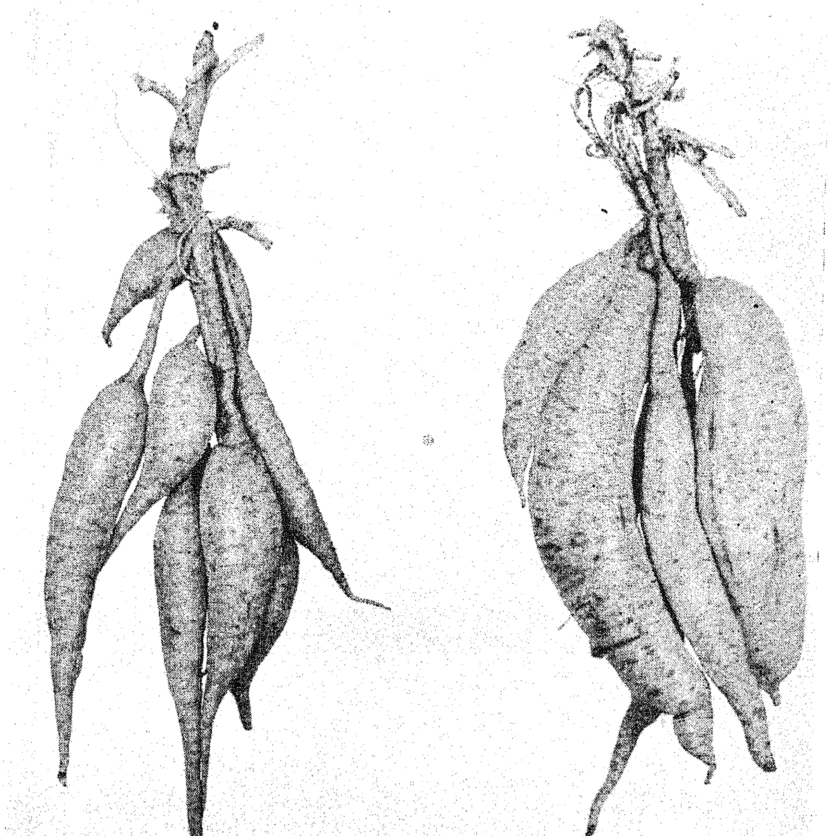


FIG. 4. Tubers of the Taiwan (Formosa) varieties which produced thick uniform roots in clusters

FIG. 5. Tuba Root (*Derris malaccensis*). Three-year old plants raised from stem cuttings rooted at Delhi. Roots contain rotenone—an insecticidal material

FIG. 6. *Isaphgul* (*Plantago ovata*). A solitary plant in the mature stage. Seeds are medicinal

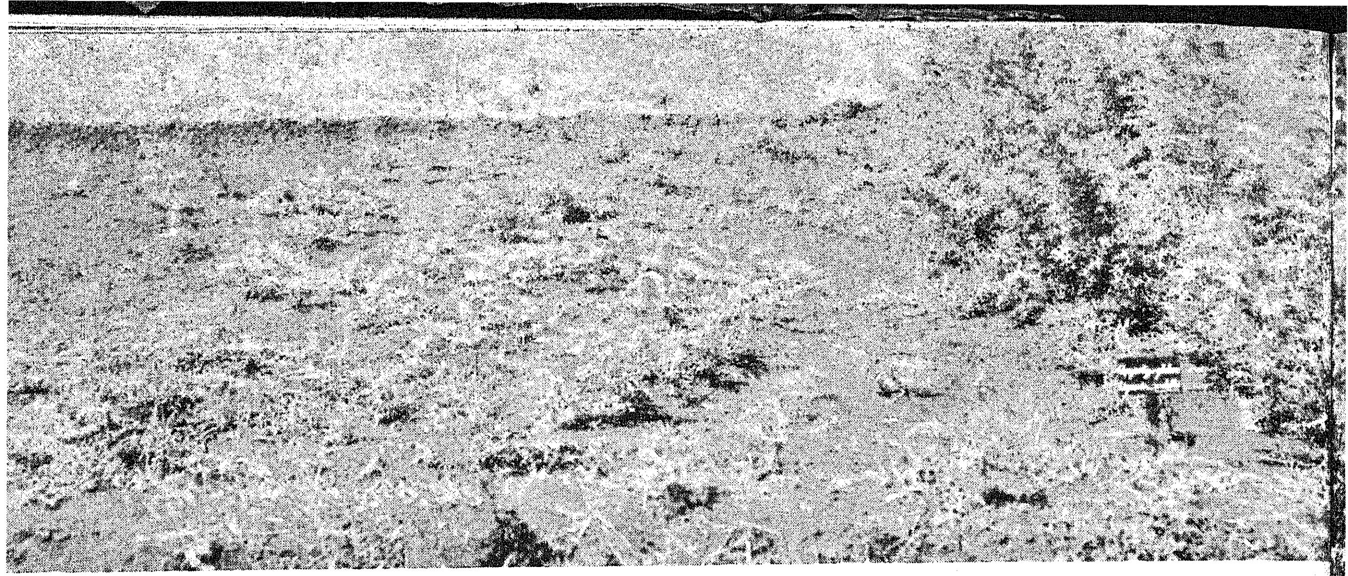


FIG. 8. Licorice (*Glycyrrhiza glabra*). On the left of the label are plants from the original planting while the scattered growths on the right are those from the stolons spreading underground

PLATE 60

FIG. 7. Psyllium (*Plantago psyllium*). A solitary plant in full bloom. Seeds are medicinal

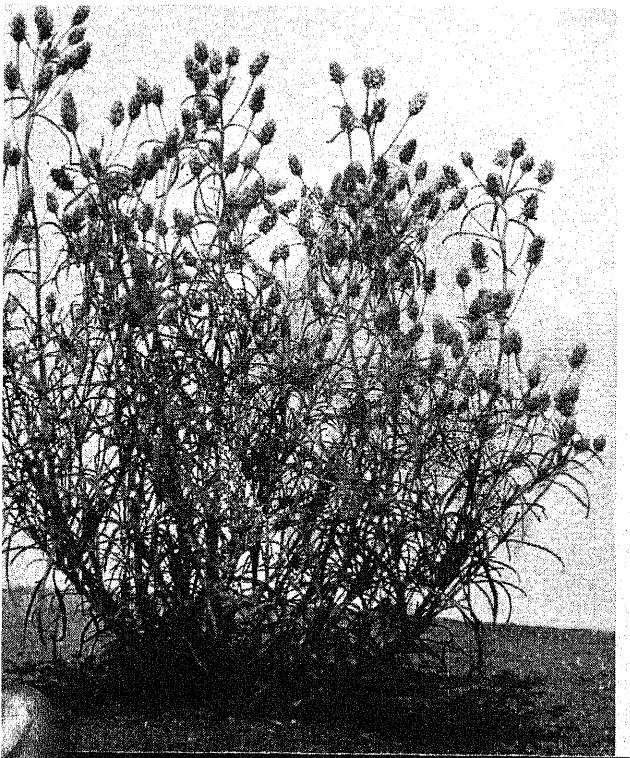
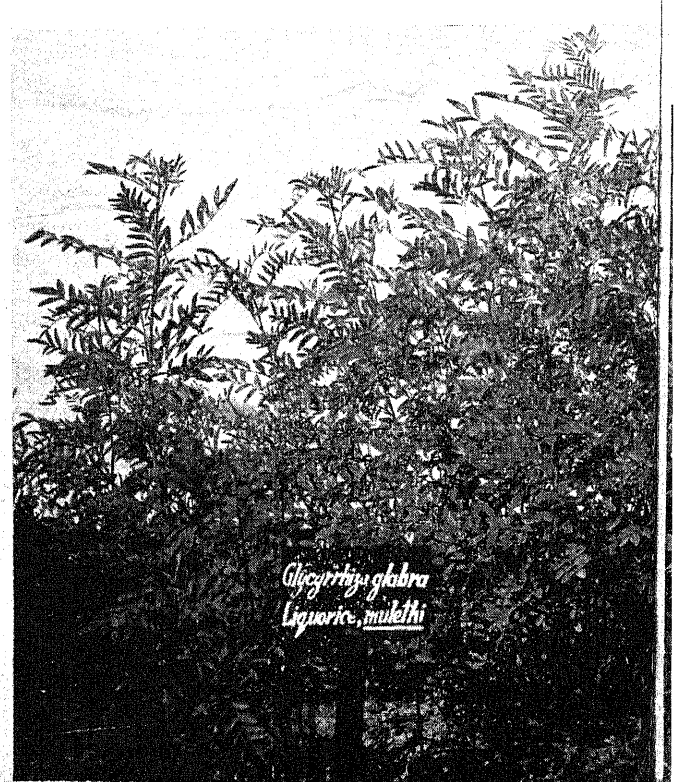


FIG. 9. A close view of the licorice plants before the onset of cold weather



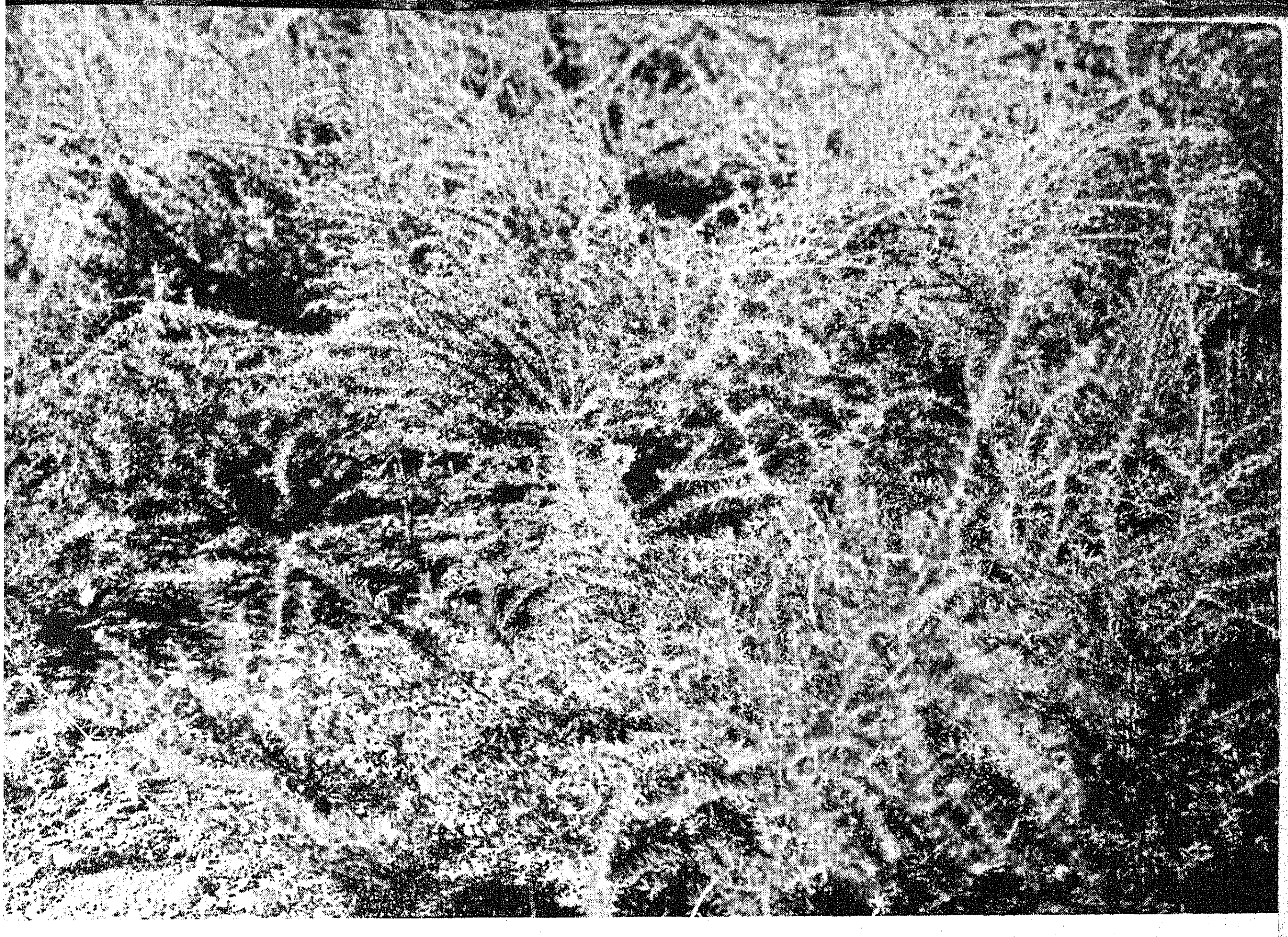


FIG. 10 (Above). A view of the crop of *Lespedeza cuneata* at the close of rainy season, showing vigorous growth. Flowers and fruits freely

PLATE 61

FIG. 11 (Below). Third year growth of the tropical kudzu (*Pueraria Phaseoloides*)

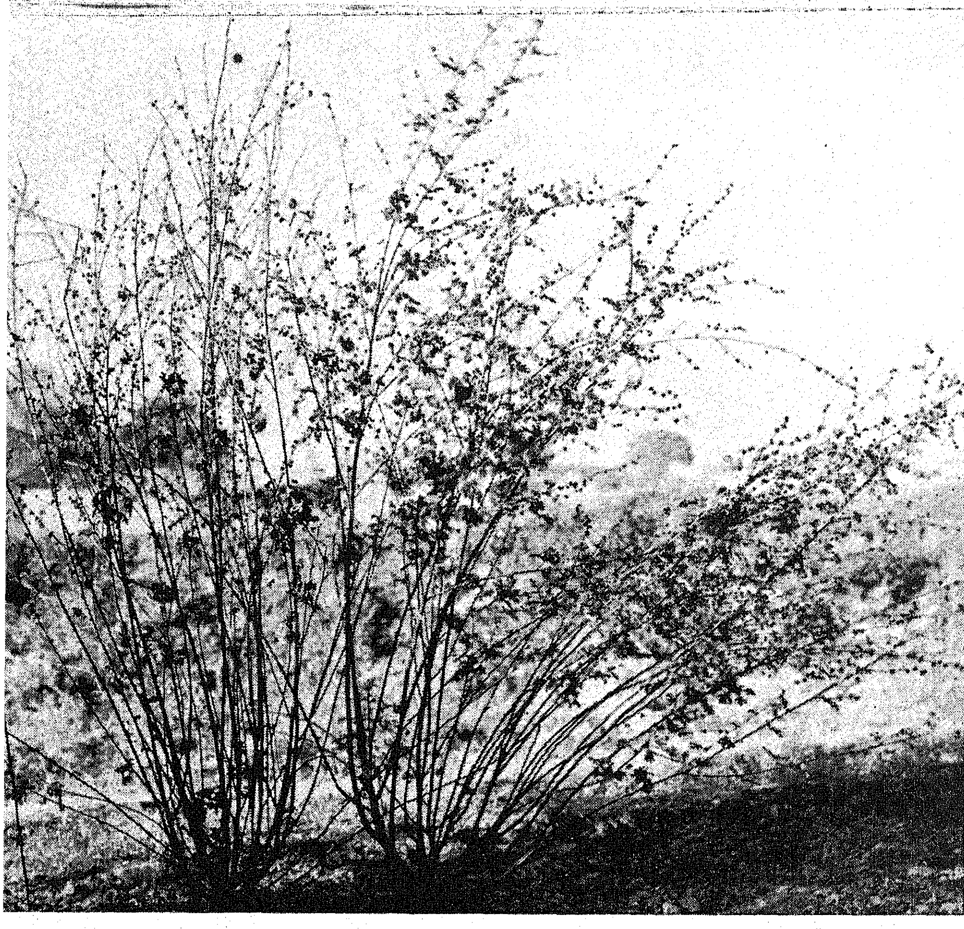


FIG. 12. The indigenous wild variety of Aramina (*Urena lobata*)—an important fibre plant of latin America, grown at Delhi. Produces fibre of good quality.

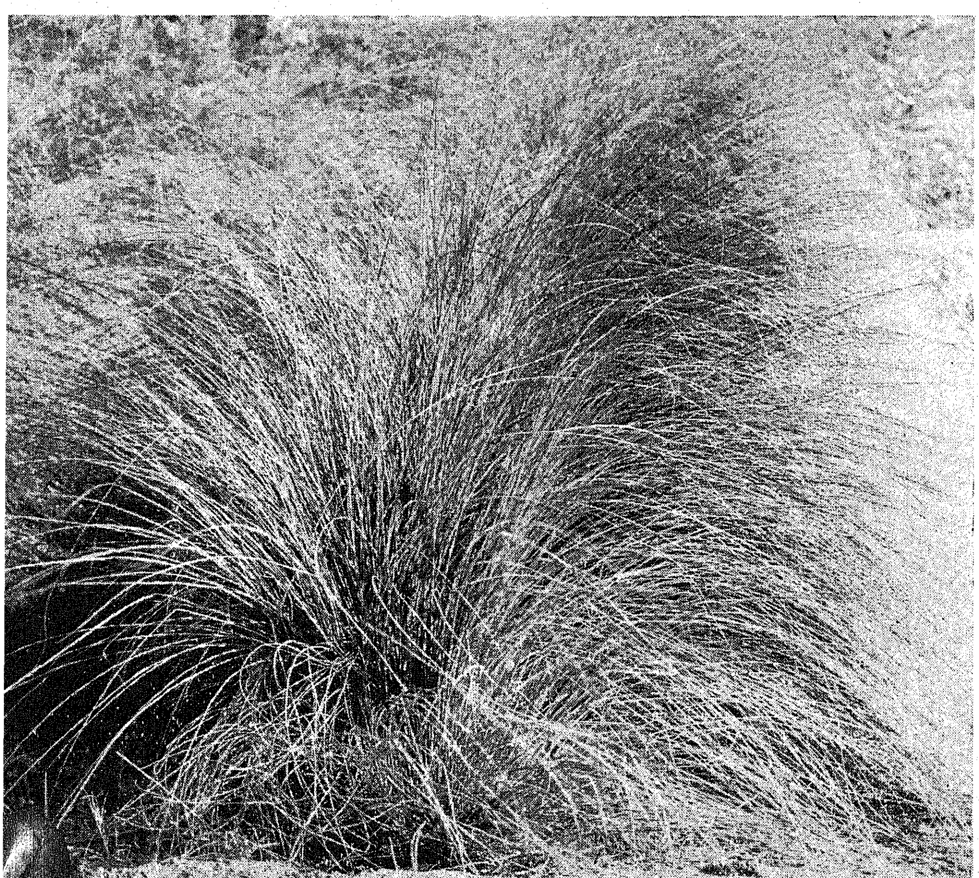


FIG. 13. One year old plants of the Kenya variety of weeping love grass (*Eragrostis curvula*)—a well known plant for soil conservation.

E.C. 953* : *Elusine* sp. From U.S.A., through Mr. Boshi Sen, Almora.
E.C. 954* : *Cynodon* sp. From U.S.A., through Mr. Boshi Sen, Almora.
Molasses grasses (*Melinis minutiflora*)
E.C. 6* : From Venezuela, through the Indian Council of Agricultural Research. Said to be insect-repellent also.
Napier grass (*Pennisetum purpureum*)
E.C. 3* : From Royal Botanic Garden, Kew.
E.C. 462 : From Director, Plant Industry, Philippines.
Sudan grass (*Sorghum sudanense*)
E.C. 247*-248* : Tift Sudan grass, Sweet Sudan grass. From United States Department of Agriculture.
Kikuyu grass (*Pennisetum clandestinum*)
E.C. 364* : From Kenya. A drought-resistant pasture grass.
Reed canary grass (*Phalaris arundinacea*)
E.C. 43* : United States Department of Agriculture, through the Indian Council of Agricultural Research.
Canary grass. (*Phalaris canariensis*)
E.C. 46* : A pasture and hay grass.
Rescue grass (*Bromus catharticus* (*Bromus unioloides*)
E.C. 44* : A pasture and hay grass.
26 *grasses from U.S.A. Soil Conservation Nursery, Arizona.* (Through Dr A. T. Sen, Ministry of Agriculture, New Delhi).
(*Bouteloua curtipendula*) : A drought-resistant pasture species. E.C. 657.
Rothrock Grama (*B. rothrockii*) : E. C. 657.
Hairy Grama (*B. hirsuta*) : E.C. 676.
Blue Grama (*B. gracilis*) : E.C. 671. Considered highly palatable and a valuable pasture plant.
Cane Blue Stem (*Andropogon barbinodis*) : E.C. 655.
————— (*A. ischaemum*) : E.C. 656.
Little Blue Stem (*A. scoparius*) : E.C. 680.
Buffalo grass (*Buchloe dactyloides*) : E. C. 660. An important grazing grass.
Tall Fescue (*Festuca elatior* var. *arundinacea*) : E.C. 662. An ingredient in hay-pasture mixtures.
Giant Panic grass (*Panicum antidotale*) : E.C. 665*. Rich in protein.
Dallis grass (*Paspalum dilatatum*) : E.C. 666. A native of South America. A pasture grass, remains green in winter.
Pennisetum ciliare : E.C. 667. A pasture grass. In Northern India it is commonly known as *anjan* grass.
Smooth Brome grass (*Bromus inermis*) : E.C. 687. For hay and pasture.
Soft Chess or Soft Brome grass (*B. mollis*) : E.C. 709.
Harding grass (*Phalaris tuberosa* : E.C. 668 and 701. A pasture and hay grass.
Crested wheat grass (*Agropyron cristatum*) : E.C. 673. For hay and pasture.
Alkali Sacaton (*Sporobolus airoides*) : E.C. 670. Considered to be one of the best grazing perennial grasses.
————— (*Trichachne californica*) : E.C. 669. A tufted perennial grass.
Galleta (*Hilaria jamesii*) : E.C. 675. A perennial of desert and dry plain habitats.
Kentucky Blue grass (*Poa pratensis*) : E.C. 678. An important pasture, silage and turf grass.
Needle grass (*Stipa viridula*) : E. C. 682. A grass of plains and dry slopes of central U.S.A.
Rhodes grass (*Chloris gayana*) : E.C. 683*. A perennial stoloniferous grass suitable for hay, pasture and silage. Also a sand binder.
Red Top (*Agrostis alba*) : E.C. 684. For pasture and an ingredient in turf mixtures. It is a creeping perennial growing under a great variety of conditions.
Sand Dropseed (*Sporobolus cryptandrus*) : E.C. 686. Native to sandy open ground in central and western U.S.A. and northern Mexico.
Timothy (*Pheleum pratense*) : E.C. 688. For hay, pasture and silage.
Tift Sudan grass (*Sorghum sudanense*) : E.C. 716*. From Montana, U.S.A.
Western Wheat grass (*Agropyron smithi*) : E.C. 720. From Montana, U.S.A.
Cocksfoot (*Dactylis glomerata*) : E.C. 721. From Montana, U.S.A. For hay and pasture. Valuable for dry hill slopes and high elevations.
Big Blue Stem (*Andropogon furcatus*) : E.C. 724. From Montana, U.S.A.
Alta Fescue (*Festuca elatior.* var. *arundinacea*) : E.C. 725. From Montana. A pasture-hay type.
Mountain Brome grass (*Bromus marginatus*) : E.C. 726. From Montana, U.S.A.
Crested Wheat grass (*Agropyron cristatum*) : E.C. 727. From Montana. For hay and pasture.
————— *Agropyron cristatum* : E.C. 741. From U.S.A., through

the American Embassy, New Delhi. For hay and pasture.

——— (*Agropyron sibiricum*) : E.C. 742. From U.S.A. A valuable hay and pasture plant for arid situations.

Grasses from Australia through the Head of the Division of Agronomy, Indian Agricultural Research Institute, New Delhi :

——— (*Phalaris tuberosa*) : E.C. 750.

Cocksfoot (*Dactylis glomerata*) : E.C. 751.

Prairie grass (*Bromus unioloides*) : E.C. 752.

Perennial Rye grass (*Lolium perenne*) : E.C. 753.

Wimmera Rye grass (*Lolium rigidum*) : E.C. 754.

Grasses from Dr Bernardo Rosengurth Campo Experimental de Pastos Estoncia Rincon de Santa Elena Estacion Dr Abjandro Gallenial, Uruguay, South America :

——— (*Rottboellia selloane*) : E.C. 869.

Teosinte (*Euchlaena mexicana*) : E.C. 874. A vigorous growing tillering species closely related to maize.

Paspalum almum : E.C. 876.

P. nicorae : E.C. 877.

P. dilatatum : E.C. 929.

Tridens brasiliensis : E.C. 878.

Phalaris tuberosa var. *stenoptera* : E.C. 925.

Bromus brevis : E.C. 926.

B. coloratus : E.C. 927.

B. carinatus : E.C. 928.

Danthonia richardsonii : E.C. 930.

D. cirrhata : E.C. 931.

Giant Fescue (*Festuca arundinacea*) : E.C. 932.

Axonopus suffultus : E.C. 933. A perennial creeping grass suitable for permanent pastures.

Rhodes grass (*Chloris gayana*) : E.C. 934. A perennial hay grass.

Grasses for soil conservation

African Love grass (*Eragrostis curvula*) : E.C. 249**. From South Africa.

African Love grass (*Eragrostis curvula*. var. *valida*) : E. C. 250*. From South Africa.

Lehman Love grass (*Eragrostis lehmanniana*) : E.C. 296**. From the United States Department of Agriculture.

Weeping Love grass (*Eragrostis curvula*) : E.C. 363. From Kenya (Fig. 13).

——— *Eragrostis superba* : E.C. 661*. From Soil Conservation Nursery, Tucson, Arizona, U.S.A.

Boer Love grass (*Eragrostis chloromelas*) : E.C. 667*. From Arizona. One of the three important introduced grasses for soil conservation in U.S.A.

Lehman Love grass (*Eragrostis lehmanniana*) : E.C. 679. From Arizona.

Weeping Love grass (*Eragrostia curvula*) : E.C. 690. From Arizona. E.C. 689. From Texas.

Zoysia pungens : E.C. 710. From U.S.A. through Dr A. T. Sen. Suitable for turfs.

Bahia grass (*Paspalum notatum*) : E.C. 2*. From Kew. E.C. 873. From Uruguay.

Fodder and forage legumes

Annual Lespedeza (*Lespedeza striata*) : E.C. 343*. From U.S.A., through the American Embassy, New Delhi.

Perennial Lespedeza (*L. sericea*) : E.C. 342**. From (as above). Susceptible to cold. But can be grown as a perennial in Delhi (Fig. 10).

Barrel clover (*Medicago tribuloides*) : E. C. 5A*. From Australia. Mainly a pasture species.

Tropical Kudzu (*Pueraria phaseoloides*) : E.C. 344**. From Puerto Rico, through the American Embassy, New Delhi (Fig. 12).

Tropical Kudzu (*Pueraria phaseoloides*) : E.C. 654. From Ceylon. E.C. 705. From U.S.A. E.C. 749. From Australia (Fig. 12).

Kudzu vine (*Pueraria hirsuta*) : E.C. 704. From U.S.A. A perennial vine native to Japan and China and often grown elsewhere as a forage plant and for soil conservation.

Legumes from Soil Conservation Nursery, Arizona, U.S.A., through Dr A. T. Sen.

Blanket Indigo (*Indigofera pilosa*) : E. C. 706.

Button Medic (*Medicago orbicularis*) : E.C. 663. A useful pasture plant.

Burr Medic (*Medicago hispida*) : E.C. 707. Annual. Promising forage plant.

White sweet clover (*Melilotus alba* var. 'evergreen') : E.C. 664.

White sweet clover (*Melilotus alba*) : E.C. 693. For hay, pasture and soil improvement.

Hubam clover (*M. alba*. var. *annua*) : E.C. 696. Annual sweet white clover.

White sweet clover (*M. alba*) : E.C. 702. A variety of biennial white sweet clover.

Yellow sweet clover (*M. officinalis*) : E. C. 694. For hay, pasture and also as a bee pasture plant.

White clover (*Trifolium repens*) : E.C. 692.

Common vetch (*Vicia sativa*) : E.C. 699.

Hairy vetch (*Vicia villosa*) : E.C. 700.

From Agricultural Experiment Station, Montana, U.S.A. :

Ladak Alfalfa (*Medicago media*) : E.C. 723. For hay and pasture.

Birdsfoot Trefoil (*Lotus corniculatus*) : E.C. 719. Grown in seed mixtures.

Strawberry clover (*Trifolium fragiferum*) : E.C. 717. For pasture and hay.

Lodins' clover (*Trifolium repens* var. *lotum*) : E.C. 718.

From Auckland University, New Zealand :

Medicago glutinosa : E.C. 772. A native of Caucasia. Said to be a dense and leafy legume.

White clover (*Trifolium repens*) : E.C. 780. (Certified mother seed).

Perennial pasture (*Trifolium repens*) : E.C. 781.

Montgomery Red clover (*T. pratense*) : E.C. 782.

Broad Red clover (*T. pratense*) : E.C. 783.

From Dr Roland McKee, United States Department of Agriculture, through the Head of the Division of Agronomy, Indian Agricultural Research Institute, New Delhi :

Korean Lespedeza (*Lespedeza stipulacea*) : E.C. 863. Annual. Valuable for grazing and hay.

Common Lespedeza (*L. striata*) : E.C. 864. Annual.

Perennial Lespedeza (*L. cuneata*) : E.C. 865. Also for soil conservation.

Sweet Blue Lupin (*Lupinus angustifolius*) : E.C. 854. As a fodder has great palatability and high protein content. Suitable for poor light land.

Sweet Yellow Lupin (*L. luteus*) : E.C. 855. A fodder crop.

Yellow sweet clover (*Melilotus indica*) : E.C. 857.

Medicago hispida : E.C. 858.

Field pea (*Pisum arvense*) : E.C. 853.

Sesbania macrocarpa : E.C. 862.

Crimson clover (*Trifolium incarnatum*) : E.C. 856. For hay.

Common vetch (*Vicia sativa*) : E.C. 850. For hay, silage and soil conservation.

Purple vetch (*V. atropurpurea*) : E.C. 851. For hay, silage and pasture.

Hairy vetch (*V. villosa*) : E.C. 852.

From Dr Bernardo Rosengurth Campo Experimental de Pastos Estoncia Rincon de Santa Elena Estac ion Dr Abjandro Gallenial, Uruguay, South America :

Desmodium discolor : E.C. 870. Perennial. Best known legume for cattle pastures on good soil in Brazil.

D. purpureum : E.C. 871.

D. batocaulis : E.C. 872.

D. cuneatum : E.C. 880.

Lespedeza hedysaroides) : E.C. 879.

Birdsfoot Trefoil (*Lotus corniculatus*) : E.C. 935. Grown in mixtures.

Trifolium ambiguum : E.C. 758.

Hairy vetch (*Vicia villosa*) : E.C. 866.

V. bengalensis : E.C. 867.

V. naturalizada : E.C. 868.

Medicinal and insecticidal plants

From Agricultural College, Lyallpur (*Punjab*). *Original source not known* :

Licorice* (*mulethi*) (*Glycyrrhiza glabra*) (Papilionaceae) : Very suitable for Delhi conditions (Fig. 8 and 9).

Henbane* (*Hyoscyamus niger*) (Solanaceae).

Wild Henbane* (*H. muticus*).

Psyllium (*Plantago psyllium*) (Plantaginaceae). Can be succesfully grown at Delhi (Fig. 7).

Derris (Tuba root) (*Derris malaccensis*) (Papilionaceae) : Source of rotenone (Fig. 5).

Peppermint (*Mentha piperita*) (Labiateae).

Tephrosia vogelii (Papilionaceae) : Source of rotenone. From East Africa. E.C. 20.

Cinchona (*Cinchona ledgeriana*) : E.C. 272. From Philippines, through the American Embassy, New Delhi.

——— (*C. succirubra*) : E.C. 271. From Philippines, through the American Embassy, New Delhi.

Wild relatives of crop plants

Wild relatives of wheat

Couch grass (*Agropyron semicostatum*) : E.C. 222*. From China.

——— (*A. elongatum*) : E.C. 240. From Australia.

——— (*A ciliare*) : E.C. 223*: From China.

Crested wheat grass (*A. cristatum*) : E.C. 673*. From U.S.A.

Western wheat grass (*A. smithi*) : E.C. 691. From Soil Conservation Nursery, Arizona.

Western wheat grass (*A. smithi*) : E.C. 720. From Montana, U.S.A.

A. sibiricum : E.C. 742*. From U.S.A., through the American Embassy, New Delhi.

A. scabrifolium : E. C. 923*. From Uruguay.

Aegilops triuncialis : E.C. 209*. From Kew.
A. ventricosa : E.C. 208*. From Kew.
Russian wild ryegrass (*Elymus junceus*): E.C. from Australia.
E. dahuricus : E.C. 808. From Australia.
Brachypodium phoenicoides : E.C. 245. From U.S.A.
Wild relatives of barley.
Hordeum stenostachys : E.C. 924. From Uruguay.
Wild relatives of oat.
Avena ludoviciana : E.C. 920. From Uruguay.
A. strigosa : E.C. 921. From Uruguay.
A. fatua : E.C. 708*. From San Fernando Nursery, U.S.A.
Wild relatives of maize.
Teosinte (*Euchlaena mexicana*): E.C. 874*. From Uruguay.
Wild relatives of tomato.
From Dr L. C. Luckwill, Long Ashton, Bristol, England.
Potato leaf (*Lycopersicon esculentum.* sub sp. *typicum* var. *grandifolium*) : E.C. 478.
L. esculentum, sub. sp. *intermedium* : E.C. 479.
L. esculentum typicum var. *pyriforme*) : E.C. 481*.
L. esculentum typicum : var. *validum* : E.C. 482*.
L. esculentum typicum : E.C. 478.
L. esculentum sub. sp. *gleni* : E.C. 488, 489 and 490.
Yellow currant (*L. pimpinellifolium*) : E.C. 483*.
Red currant (*L. pimpinellifolium*) : E.C. 484*.
L. esculentum sub. sp. *Humboldtii* : E.C. 485.
L. hirsutum var. *agrimoniaefolium* : E.C. 486.
L. peruvianum sub. sp. *dentatum* : E.C. 492*.
L. peruvianum sub. sp. *puberulum* : E.C. 493*.
L. peruvianum sub. sp. ? : E.C. 494*.
L. glandulosum : E.C. 495.

Other plants

Buckwheat (*Fagopyrum esculentum*) : E.C. 322*, 323*. From China. Early maturing varieties (Fig. 3).
Caesalpinia sepieria : E.C. 35*. From Kenya. A hedge plant.
Tephrosia candida : E.C. 19*. From East Africa. A shrub useful as a cover plant in plantations and also for green manuring.

Indigenous collection

Food plants

Tapioca (*Manihot utilissima*) : Euphorbiaceae. Three varieties namely Ariyan, Kalikalan and Anakomban received from Travancore. The general growth of the plants at Delhi is shown in Fig. 1.

Fodder and forage grasses

*Apluda aristata** : A good forage grass of Simla hills. Well-acclimatized at Delhi.
*Bromus unioloides** : From Simla. Well-acclimatized at Delhi.
*B. japonicus** : From Quetta, Baluchistan.
*Chrysopogon montanus** : A drought-resistant perennial grass.
Anjan grass (*Cenchrus ciliaris**) : Perennial pasture grass.
Anjan grass (*C. setigerus**) : Allied to above.
*Eragrostis gangetica** : Originally from Puri (Orissa). Resembles African Love grass. Said to be valuable for cattle fodder, both fresh and dry.
*Lolium perenne** : From Quetta, Baluchistan.
*Phalaris minor** : An annual winter grass. Grows prodigiously.
*P. paradoxa** : From Baluchistan.
*Pennisetum orientale**) : A perennial grass of Himalayan ranges, acclimatized at Delhi.

Fodder and forage legumes

(*Alysicarpus rugosus**) : A quick-growing fairly tall annual.
(*Atylosia scarabaeoides*) : A twining legume.
Wild Sword Bean (*Canavalia virosa**) : A prolific legume growing wild at Baroda. Grows well at Delhi under cultivation.
*Indigofera trifoliata** : A fairly quick-growing vigorous legume from Central Provinces, suitable for growing in the hot weather and rainy season.
*I. linifolia** : A rainy season annual.
Senji (*Melilotus alba**) : Local wild white sweet clover.
Senji (*M. indica**) (*M. parviflora*) : Local wild yellow sweet clover.
Maina (*Medicago denticulata*)* : A winter legume.
*Phaseolus trilobus** : For fodder and green manuring.
Wild Fenugreek (*Trigonella polycerata**) : A winter legume.

Vetch (*Vicia sativa**) : Local wild variety.
*V. hirsuta** : Local wild variety.

Other legumes

Avaram bark (*Cassia auriculata**) : For green manuring and tanning purposes. Originally from Rajputana.
C. hirsuta : From Jeypore (Orissa). A leafy herbaceous shrub.
Bara Panwar (*C. occidentalis**) : Delhi local.
Panwar (*C. obtusifolia**) : Delhi local.
*C. sophera** : From Mussooree.
*C. sophera** var. *purpurea** : A hedge plant.
Wild indigo (*Indigofera tinctoria**) : Wild in Delhi.
*I. hirsuta** : A possible green manuring plant.
Lespedeza (*Lespedeza cuneata=L. sericea*) : Collected from Himalayan ranges and grown at Delhi.
Tropical Kudzu (*Pueraria phaseoloides*) : Collected from Dehra Dun.
*Rhyncosia aurea** : A trifoliate trailing legume of rainy season.
*Tephrosia purpurea** : A possible green manuring and insecticidal plant.

Fibre plants

*Corchorus olitorius** : (Tiliaceae) : Wild variety of the jute species. Delhi local.
(*C. capsularis**) : Wild variety of the common jute species. From Karnal (East Punjab).
Wild *Okra* (*Hibiscus ficulneus**) (Malvaceae) :
(*H. micranthus*) : A perennial plant growing on the dry ridge at Delhi.
Aramina (*Urena lobata*) : A perennial fibre plant (Fig. 11).

Medicinal and insecticidal plants

(*Artemisia vulgaris**) : Compositae. From Bhowali (Nainital). Yields santonin which is used for expelling worms from the intestines.
(*Chenopodium ambrosoides*) (Chenopodiaceae) : Yields oil of chenopodium used in expelling worms from the intestines. Originally from Bhowali (Nainital).
Jimson weed (*Datura stramonium**) (Solanaceae): Purple and white-flowered varieties. Yields the drug stramonium.
(*D. metel**) : Purple and white-flowered varieties.
(*Lallemantia royleana**) (Labiatae) : The mucilaginous seeds are medicinal in the indigenous systems of medicine.
Isafgol (*Plantago ovata*) (Plantaginaceae) : Seeds medicinal. Grown successfully at Delhi (Fig. 6).

Wild relatives of cultivated plants

Wild relatives of brinjal or eggplant (Solanum melongena *L.*) :
*S. incanum** : A hardy perennial solanum the fruits of which are resistant to borer attack.
S. *indicum** : A small-fruited spiny plant, with all flowers long-styled.
S. *torvum** : A perennial bushy species with small berries.
S. *xanthocarpum** : A drought-resistant spreading annual.
S. *verbasifolium** : A non-spiny shrubby plant.
S. *hispidum** : A grey-tomented tall-growing plant from Dehra Dun—Mussooree area.
*S. khasianum** : A frost-resistant species, susceptible to heat. Spiny with non-bitter fruit.
S. *nigrum** (*makoh*).

Wild relatives of sann hemp (sanai) (*Crotalaria juncea*) (Papilionaceae) :
*C. sericea** : A leafy rather slow-growing legume with bold flowers. Delhi local and Cuttack (Orissa) varieties.
*C. retusa** : A low, much branched herbaceous plant. From Baroda and Cuttack (Orissa).
*C. usaramœnsis** : A slow-growing fairly tall plant. Late in flowering.
*C. lanceolata**.
*C. mysorensis** : A very early maturing species. Delhi local.
*C. tetragona** : From Dehra Dun.
*C. medicaginea** : An erect trifoliate legume resembling lucerne in general habit. It is an annual.
C. orixensis : A spreading trifoliate legume. From Nagpur.
C. pumilla : A simple-leaved legume with basal shoots spreading on the ground. Main shoot rather erect. From Nagpur.

Wild relatives of bhendi *or* okra (*Hibiscus esculentus*) (Malvaceae):

*H. ficulneus**: From Delhi, East Punjab, Guntur (S.I.), Ratlam (C.I.).

*H. tetraphyllus**: From Baroda, Bengal, Saharanpur (U.P.)

H. pungens: From Dehra Dun.

H. abelmoschus: From Dehra Dun.

H. rugosus: From Nagpur.

Wild relatives of wheat (Triticum spp.) (Gramineae):

Agropyron semicostatum: Himalayan

A. longe-aristatum: Himalayan.

*Aegilops squarrosa**: From Quetta, Baluchistan.

Wild relatives of Barley:

H. murinum: From Quetta, Baluchistan.

H. distichon: From Quetta, Baluchistan.

Wild relatives of maize (Zea Mays):

*Coix lachryma-jobi** (Job's tears): From Dehra Dun.

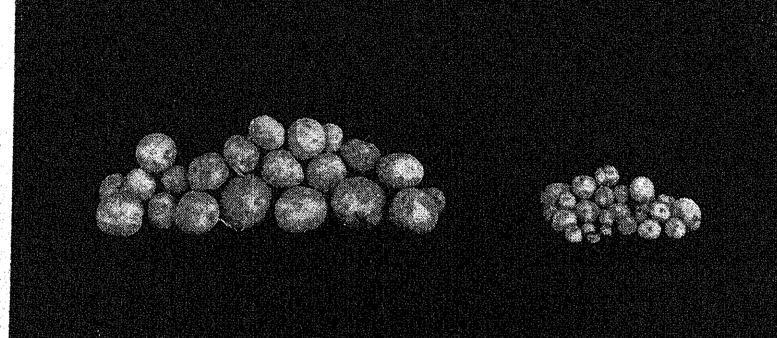
*Eluchlaena mexicana**: Teosinte.

HYBRID *CUMBU*

TWO new hybrid *cumbu* varieties X.1 and X.2 were recently released for trial from the Millet Breeding Station, Coimbatore. They have been produced by crossing promising pure lines which exhibited the maximum hybrid vigour when crossed. District trials, conducted in Tiruchirapalli district in the Musiri and Perambalur taluks have been very encouraging. Extensive trials are being arranged in the coming season to find other areas suitable for cultivating the hybrid *cumbu* X.1 and X.2.—*Agricultural Newsletter, Madras,* July, 1949.

FIG. 1. Partially disease-free potatoes

FIG. 2. Partially disease-free potatoes



SEED FROM PARTIALLY DISEASE-FREE POTATO CROP

By R. S. VASUDEVA and R. N. AZAD

THE virus diseases of potato are common wherever potato crop is cultivated and cause considerable losses in yield every year. The survey conducted of all the main potato-growing areas in Northern India in this connection has established the widespread occurrence of virus diseases and their high incidence in some localities. With a view to establish the potato industry of the country on a sound basis so that a regular flow of potatoes, which is an important food commodity, is ensured, it is imperative that largescale production of seed potatoes of high quality, free from disease and varietal mixture, be undertaken. With this object in view the Indian Council of Agricultural Research have already taken steps for the certification of seed potatoes in the country, and a scheme in this connection is in operation at the Indian Agricultural Research Institute since 1942. Though the building up of nucleus and large-scale production and distribution of seed potatoes is the only practical method of combating virus diseases, it involves a long range work which is to be carried out over several stages and will take a number of years before disease-free certified seed is available to the cultivators. This scheme cannot, therefore, contribute to the promotion of food production immediately in these days of serious food deficit in the country. As an immediate step to increase the outturn of potatoes per acre, the Indian Council of Agricultural Research launched a scheme on the same principles as seed potato certification but for the production of partially disease-free seed, free from severe types of mosaic, streak and leaf roll which could be made available to the cultivators without delay.

In partially disease-free seed potatoes freedom from serious types of virus diseases is more or less achieved, and this alone brings about substantial increase in yield per acre. Figures 1 and 2 show apparently healthy and mosaic-affected plants of potato var. *Phulwa* with their respective yields.

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Production of partially disease-free seed potatoes

(a) The procedure adopted to achieve this object is briefly described below. Production of partially disease-free seed potatoes is based on the principle of 'mass roguing' of diseased plants. An isolated piece of land about 500 ft. away from other potato fields is taken and planted with commercial seed of the desired variety. It is however desirable that the seed material for initial planting is selected from a crop having a low disease incidence. Clean cultivation and elimination of all weeds throughout the growing period of the crop are also important. The crop is to be constantly kept under observation. Individual plants are examined for disease symptoms at regular intervals and all the plants exhibiting severe types of symptoms are immediately rogued out. While roguing care should be taken so that no portion of the diseased plant is left over in the field and all the tubers along with the plants are removed. The plants soon after roguing are taken in a closed container to prevent the escape of insect vectors away from the seed plot and buried. Any off-type plants are also rogued out during these operations in order to ensure the purity of variety. During roguing and cultural operations hands and tools should be disinfected to reduce the spread of the disease to the minimum. In order to avoid secondary infection the crop should be lifted comparatively early, i.e. soon after the foliage becomes pale. Success of the operation depends on 'thoroughness' and 'earliness' of roguing so that the plants showing the first symptoms of disease are immediately eradicated.

(b) The production of partially disease-free seed potatoes was undertaken at the

Indian Agricultural Research Institute and the results are briefly described below. In 1944 seed potatoes of *Phulwa* and *Darjeeling Red Round* varieties were purchased from pockets of low disease incidence and planted at the Agricultural Sub-Station of Indian Agricultural Research Institute, Karnal. The initial infection in the crop varied from 21·0 to 27·0 per cent. But in 1945 part of the material raised from the previous crop was planted and about 22 acres of standing crop with comparatively low disease incidence was purchased at Hapur in the United Provinces. In view of the previous year's experience, in 1946 after survey the entire crop with low disease incidence was purchased. The work during the later two years was confined to *Phulwa* variety. During 1944, 1945 and 1946 altogether 963, 2,782 and 3,026 maunds respectively of seed material were distributed to Provincial and State Governments as well as to Military Farm Depots in certain areas. The major portion of the material was, however, taken over by the United Provinces Department of Agriculture for further multiplication and distribution. The records of performance were supplied by the United Provinces Department of Agriculture.

Performance

The Department of Agriculture, Bihar, which took over a small quantity of seed potatoes from the first lot in 1945 observed that the crop raised from the partially disease-free seed, supplied under the scheme, showed 3·5 per cent disease incidence as against 15 to 25 per cent in the local crop.

The crop raised from seed material supplied to the United Provinces exhibited considerably low disease incidence as compared to the local crops. The yield of tubers raised from such seed was also considerably higher than that raised from the local crops. During 1947-48 a maximum yield of 427 maunds per acre was obtained at Hapur and this has been considered by the Department of Agriculture, United Provinces, to be the record yield for *Phulwa* variety.

The disease incidence and outturn of potatoes from the seed supplied under the scheme and the local crops are compared in Table I.

TABLE I

Disease incidence and yield from crop raised from partially disease-free seed

Year	Locality	Partially disease-free seed		Commercial seed		Maximum yield in maunds per acre from partially disease-free seed
		Per cent disease incidence	Yield in maunds per acre	Per cent disease incidence	Yield in maunds per acre	
1945-46	Meerut	3·5	233	20–25	175	300
	Farrukhabad	2–10*	235	60–70	200	322
1946-47	Hapur	3–4	250	20–70	175	...
	Farrukhabad	1–2	220	50–60	150–200	300
1947-48	Hapur	1–2	250	50–75	125	427
	Farrukhabad	...	250	...	...	...

* The higher disease incidence in Farrukhabad area appears to be due to the badly infected neighbouring crop.

The performance of partially disease-free seed potatoes distributed under the scheme has obviously been extremely satisfactory from the point of view of disease incidence and outturn. The germination was almost 100 per cent in all the localities where the seed was grown. It has generally been observed that the crop raised from partially disease-free seed potatoes

suffered less from the adverse effect of frost as compared to the local crop and that the seed appeared to be of better keeping quality. The crop was also not so severely affected by early blight which appeared in an epidemic form at Hapur in 1947-48. The general growth and development of plants was found to be very satisfactory with the result that the growers in those localities have shown keenness for having their crop examined for diseases and obtaining disease-free seed material because of the additional benefit accruing from it. It is, therefore, essential that till disease-free certified seed stocks are available to the growers for distribution, partially disease-free seed material be multiplied on a large scale and made available to the growers as it would considerably help in increasing the output of potatoes per acre.

Thanks are due to late Mr. O. P. Rikhi for his untiring efforts and assistance in the production and distribution of seed material. Thanks are also due to Thakur Ram Surat Singh, Deputy Director (Gardens), Lucknow, for his constant cooperation during the course of this work.

LOCUST VISITATIONS

VISITATIONS of locusts which have, from times immemorial, been considered as one of the major enemies of agricultural production have always been periodical and during the last 140 years, some 14 outbreaks covering a period of 10 years on an average have occurred in India. The last two outbreaks, covering the periods 1926-31 and 1940-46 were quite serious. A good rainfall which is a boon to the cultivator in many ways provides, however, the most favourable condition for locust breeding. The fecundity of the locusts is very great: one pair alone is capable of producing nearly 5,000 adults within a period of five months. (*P.I.B.*)

COST OF PRODUCTION OF WHEAT ON THE GOVERNMENT FARM, KALYANPUR (KANPUR)

By G. D. AGRAWAL and RAM SARAN

'FARM Management Studies' represent the most neglected branch of agricultural researches in India. Even the importance of 'Cost of Production Studies' has been seldom realized. They are conspicuous by their absence particularly on a continuous basis save the Punjab where farm accounts are published yearly by the Punjab Board of Economic Enquiry. The need of such studies was never more than today when the State has to adopt a number of measures, e.g. price stabilization, abolition of *zamindari*, fixing of fair rents and minimum agricultural labour wages, crop insurance, etc. In the following article cost of cultivation and production of wheat has, therefore, been studied on a long term basis since 1939-40.

Kalyanpur Farm

Kalyanpur Farm is situated on the Grand Trunk Road nearly five miles from Kanpur city. The farm is canal-irrigated and possesses fertile irrigated loam which gives luxuriant plant growth. Wheat is generally taken after fallow or green manuring with *sanai*. The cultivation operations consist of two to three ploughings with soil-turning plough and five to six ploughings with *desi* plough. Two irrigations followed by weeding and hoeing are given. In years of deficient rainfall, however, towards the end of September the fields have to be irrigated before preparatory tillage, increasing the number of irrigations to three. Often six to eight cartloads of farmyard manure are applied, per acre, to wheat when sown after fallow. Cakes or fertilizers are occasionally used. The crop is usually sown by the middle of October and matures in about six months, i.e. mid-April. The average area under the crop, on the farm, is about 60 acres.

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Cost of cultivation

Table I gives the cost of cultivation and gross and net incomes per acre together with the cost of production per maund of wheat grain. The war had increased the cost of temporary labour and bullock feeds. This is partly responsible for a little rise in the total cost of cultivation. But the price disturbances soon subsided and the average of the two years, i.e. 1939-40 and 1940-41 is a fairly representative figure for the cost of cultivation of wheat before the war.

Strictly speaking it may be pointed out that the yearly cost figures of Table I are not good comparables, being dependent on natural and local factors which materially change the cultural operations schedule of a year. Of the former, the amount and distribution of rainfall and of the latter the availability of labour and the manure supply are of importance. Also the different cultivation practices, e.g. the number of ploughings, interculture and irrigations have not been uniform in all the years.

The rise in the cost of cultivation since 1940-41 has been almost continuous. The year 1945-46 witnessed the highest increase, the index* having risen to 207. A detailed study of the cultivation records has revealed that, taking into account the individual items, the highest increase has been in the case of seed and manure, the indices being 396 (in 1944-45) and 395 (in 1945-46) respectively. The next highest increase is to be found in bullock and human labour in 1945-46, the indices being 268 and 208 respectively.

* The base, for all the indices given in the article, is the average of 1939-40 and 1940-41.

TABLE I

Cost of cultivation per acre in rupees

Year	Labour	Bullocks	Other expenses	Total expenditure.	Total income	Profit and loss	Cost of production (per maund of grain)	Yield of grain per acre	Wholesale harvest price of grain (per maund)	Market rate of *bhusa* (per maund)
								Md.	Rs.	as.
1939–40	42·98	49·17	68·55	160·70	140·22	20·48	4·40	28·68	3·69	0·67
1940–41	33·33	32·22	56·34	121·89	164·81	42·92	2·11	30·96	3·50	1·00
1941–42	33·64	35·19	80·50	149·33	239·90	90·57	2·89	25·95	6·38	1·60
1942–43	27·33	34·37	88·59	150·29	394·83	244·54	2·85	23·51	13·25	20·0
1943–44	37·40	67·18	98·32	202·90	311·03	108·13	4·35	15·12	11·50	5·00
1944–45	47·86	71·46	99·30	218·62	351·05	132·43	5·23	20·42	11·69	2·86
1945–46	79·44	108·96	105·32	293·72	413·02	119·30	6·61	20·94	12·31	4·00
1946–47	57·48	106·60	100·63	264·71	374·35	109·64	7·12	21·14	12·31	3·00
1947–48	62·37	91·99	107·31	261·67	590·99	327·32	6·88	21·65	22·00	3·00

'Other Expenses' in Table I column 4 include expenditure on land, seed, manure, irrigation, machinery, repairs of the dead stock, supervision, miscellaneous, interest on working capital and lastly the depreciation and interest on fixed capital. The charges under land and depreciation and interest on fixed capital have remained stationary. Supervision charges have increased since 1942-43 owing to an increase in pay and war allowances of the supervisory staff. The interest has been charged at the rate of 6 per cent per annum for six months on the total working capital and at the rate of 3 per cent on the fixed capital. It is clear that the increase in cost has been all round except land and depreciation and interest on fixed capital. The two main factors which have materially influenced the rise of cost of cultivation as a whole are human and bullock labour as they together constitute 57·4 per cent of the total cost of cultivation of the crop.

Cost of production

With the rising prices the cost of cultivation per acre has shown a progressive increase. Ordinarily it varies within a narrow range but the cost of production per maund of grain shows wide and violent fluctuations as it depends on the yield which itself is very variable and uncertain on account of a number of natural factors over which human agency has no control. The variation in the yield of grain per acre is from 15·12 to 30·96 maunds, the average for the period being 23·16. Similarly the cost of production per maund has varied from Rs. 2·11 to Rs. 7·12, the average being Rs. 4·74. The average cost of production for the last three years, however, is Rs. 6·87. The cost of production of grain has been calculated after deducting the income from *bhusa* from the total income.

Table II gives the percentages of expenditure under different heads for the pre-war period and the present times and shows how the relative different rates of increase have affected their relationship to the total cost during the two periods.

As rent and irrigation charges have varied but little, the per-war ratio of their cost to the total cost of cultivation, i.e. 11·9, has come down to 7·1 for the current years. Supervision too shows a decrease but much less when compared to that of rent and irrigation. Percentage expenditure on bullock labour has, on the other hand, increased from 28·8 to 36·4. The increase is due to the high maintenance cost in spite of nearly three times increase in the wages, the decrease in the ratio of labour cost to total is due to a reduction to half in the quantity of labour units used.

Table III below gives the extent of human labour and cattle hour units* used per acre and their rates per day.

*Human labour and bullock hour units mean the amount of work done by a male adult and by one pair of bullocks, for one hour respectively.
8-hour units make 1 labour day.

TABLE II

Expenditures under various heads per acre

Heads of expenditure ⟶	Land	Labour	Bullocks	Manure	Seed	Irrigation	Machinery	Repairs of dead stock	Supervision	Miscellaneous	Interest on working capital	Depreciation and interest on fixed capital	Total
Pre-war (Average of 1939-40 and 1940-41)													
*1. Actual expenditure	10·5	38·16	40·69	8·44	4·66	6·34	3·35	6·26	8·75	0·46	3·69	10·00	141·30
2. Percentage to total	7·4	27·00	28·8	6·0	3·3	4·5	2·4	4·4	6·2	0·3	2·6	7·1	100·0
Present (Average of 1946-47 and 1947-48)													
*1. Actual expenditure	10·5	59·93	96.30	23·73	16·31	7·65	7·91	11·41	12·50	0·00	6·94	10·00	263·18
2. Percentage to total	4·2	22·7	36·4	9·2	6·2	2·9	3·0	4·3	4·7	0·00	2·5	3·8	100·0

* Figures are in rupees.

TABLE III

Labour and cattle hour units used and their rates

Year	Per acre				Per hour unit					
	Temporary labour	Permanent labour	Total labour	Cattle	Temporary labour		Permanent labour		Cattle	
					as.	ps.	as.	ps.	as.	ps.
1939–40	609·6	345·6	955·2	184·8	0	7·14	0	11·28	4	1·0
1940–41	603·2	203·1	806·3	154·5	0	7·03	0	11·93	3	9·0
1941 42	386·2	294·1	680·3	152·5	0	7·68	0	11·78	3	9·0
1942–43	218·9	270·4	489·3	92·2	0	8·73	1	0·40	6	2·0
1943–44	213·0	243·2	456·2	106·6	1	0·70	1	6·70	10	1·9
1944–45	155·9	294·6	450·5	91·5	1	0·20	1	9·47	12	8·0
1945–46	157·3	303·6	460·9	123·5	1	5·33	2	8·33	12	2·0
1946–47	100·2	348·3	448·5	94·8	1	5·00	2	2·89	16	6·0
1947–48	145·4	320·3	465·7	125·2	1	7·48	2	4·52	11	9·0

There has been a remarkable decrease in the use of temporary labour because of its scarcity. Whereas the average employment per acre during 1939-40 to 1941-42 was 67 labour days of the temporary labour and 35 of the permanent, the former has come to even less than half of the permanent in the current years. Last nine years' average of labour days is 75 of labour and 16 of cattle.

Temporary and permanent labour rates have increased nearly three times, the indices being 272·9 and 286·6 respectively while the increase in cattle rates is more than four times, the index having risen to 438·8.

Cultivator's cost of production

It would be wrong to consider these figures as representative of the farmer's costs. Whereas the Government farms are able to obtain most of their supplies at controlled prices, cultivators have to pay enormously. For instance, the farm under study gets cattle dung and wool waste manures on very favourable terms from the municipal markets and the local woollen mills, the facilities forbidden to cultivators. The high prices of capital items, e.g. the bullocks, implements, machinery, etc. are not reflected at all in this study for the farm is an old established one and replacements during these years have been few. Cultivator's poverty stands in the way of the use of the desired quantity of capital. He invests little on farm buildings, bullock-shed, land improvement, fencing, better implements and good bullocks. In spite of the very high rent which he has to pay he fails to make the best use of the land on account of lack of funds and facilities of good seed, adequate quantity of manure, irrigation, etc. His bullocks are small, under-sized and half-starved. The small holding hinders his putting any area under fodder for his stock. This all is reflected in poor tillage and low yield. His cost of cultivation per acre is, therefore, less but considered relatively is considerably higher. His average cost of production per maund can safely be said to be more by 25 to 50 per cent. This is further supported by the studies of the Agricultural Economics Section of the Government Agricultural College, Kanpur, on the cultivators' holdings for 1946-47 and 1947-48. However to obtain representative figures, there is great need for setting up organizations for such study in the provinces of India. The importance of cost studies on long term basis on representative holdings of cultivators need not be further emphasized. Their absence leaves a vacuum in the economic researches carried out in the country as a whole.

Acknowledgment

We wish to acknowledge our thanks to Dr B. L. Sethi, Principal, Agricultural College, Kanpur, and formerly Officer-in-Charge, Government Farm, Kalyanpur, for permitting us to make use of the farm records.

THE *per capita* expenditure on agriculture is annas 11 in India as against Rs. 20 as. 14 p. 5 and Rs. 77 as. 9 p. 11 in Canada and the U.S.A. respectively. (*P.I.B.*)

COST OF PRODUCTION OF WHEAT ON THE GOVERNMENT FARM KALYANPUR (KANPUR)

FIG. 1. Graph showing the cost cultivation of wheat, 1940 means 1939-40

FREEZING POINT OF MILK AND ITS APPLICABILITY TO DETECT ADULTERATION OF MILK

By NOSHIR N. DASTUR

COMMON tests like fat and solids-not-fat usually applied for the detection of adulteration of milk with water allow a considerable amount of adulteration to take place. This is largely due to the fact that pure milk shows great variation in composition, and also because buffalo milk which is richer in total solids than cow milk is used freely for adulteration. A method that will permit the detection of adulteration with very small quantity of water will, therefore, prove useful and help to check this evil which is widespread in the urban centres. This method should be such that it can be used with cow and buffalo milk without creating ambiguity.

A test which is finding greater use for quality control work is the freezing point of milk. The freezing point depression of milk is produced by constituents which are in solution in the milk serum, the most important of which are lactose and chloride. These together account for nearly 75 per cent of the observed depression in freezing point. The amount of lactose and chloride in milk are so adjusted by nature that any increase in one results in a corresponding decrease in the other and *vice versa*. It is largely for this reason that milk has such a constant freezing point. Constituents like fat and casein which are not in true solution in milk do not contribute anything to the observed value. This makes the test independent of the most variable factor in milk, namely, its fat percentage, and so useful for detecting adulteration. A series of exhaustive investigations with the milk of western breeds of cattle have shown that the freezing point depression is the most constant physical property of milk and is not affected by such factors as naturally occurring low solids-not-fat or any hereditary and environmental factors. The minimum depression now utilized for legal purposes in western countries is 0·530°C. Application of this test in India can therefore be expected to furnish a remedy for the difficulties already mentioned. Before this can be done, it is necessary to find out the freezing point of large number of cow and buffalo milk samples, and likely factors which may influence the value. A detailed study was therefore taken up recently at this Institute under a scheme financed by the Indian Council of Agricultural Research. In the following a summary of important results is given.

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The freezing point of milk can be determined by using different techniques but for analytical work the determination is always done with the Hortvet Cryoscope. The apparatus consists of a thermos flask in the centre of which is kept a glass tube containing the sample of milk. Surrounding this tube is a metal tube with a very small air gap in which is put some alcohol to make an even contact. The flask contains ether in which the metal tube dips. In the tube containing milk a special thermometer is kept which reads between the range +1° to −2°C. The thermometer should be of guaranteed accuracy and capable of reading to 1/1000 of a degree. When air is blown through ether, due to evaporation of ether, the temperature of milk begins to fall. Actually the milk is super-cooled to about −1°C. At this stage a tiny crystal of ice is introduced to start freezing when the temperature begins to rise and reaches a steady value. This is taken as the freezing point of milk. When using the apparatus a constant check is kept over the accuracy of the thermometer. The reading obtained is not the true freezing point of milk as the apparatus gives a value which is lower by 0·015°C. However, according to accepted standard no attempt is to be made to correct the observed reading.

Minimum freezing point of milk

Trials were first carried out with samples of milk of known purity to find out the average value for freezing point and the likely variations. For this purpose nearly 560 composite samples

of milk from Gir, Sahiwal, Sindhi, Tharparkar and cross-bred cows, and 200 samples of Dharwar and Murrah buffalo milk produced in the Institute farm were analyzed over a period of 18 months. The average freezing point of cow milk samples was —0·548°C., and that of buffalo milk —0·549°C. Over 97 per cent of all the samples examined show freezing point depression greater than 0·530°C., and so this value can be taken as the minimum limit for prescribing legal standards. In the case of cow milk nearly 96 per cent of the samples had freezing point within the range of —0·531°C. to —0·560°C. Buffalo milk samples show a wider scattering, only about 81 per cent of the samples lying within the range noted above.

The above results were obtained under Bangalore conditions, but to verify them nearly 300 samples of pure milk were collected from different farms in India and tested by this method. The samples were preserved with mercuric perchloride added at the rate of 0·075 per cent. By this method it was possible to preserve milk over a month. The observed freezing point was corrected by —0·200°C. as the preservative added lowers the freezing point. The results again confirmed that the minimum depression for milk can safely be taken as 0·530°C.

Effect of various factors on the freezing point

It is well known that the composition of milk is affected by several factors, e.g. the breed, individuality, season, stage of lactation, feed, etc. The effect of some of these factors was therefore studied with a view to find out how they will affect the results of freezing point test.

(i) *Breed of the animal:* Freezing point of milk of cross-bred, Gir, Sahiwal and Sindhi cows, and Murrah buffaloes were determined. The average freezing point depression was within the very narrow range of 0·546° to 0·549°, thus indicating that not only the breed of the animals had no marked effect on this value, but also that cow and buffalo milks give the same average value.

(ii) *Individuality of animals:* A further study was carried out involving the analysis of nearly 580 samples collected from individual animals of Sindhi and Murrah breeds. The average freezing point was —0·549°C., and nearly 96 per cent of samples gave freezing point depressions greater than the minimum value of 0·530°C. The test is therefore equally useful, both for mixed milk samples and for samples from individual animals.

(iii) *Freezing point of colostral milk:* Colostrum gives a greater depression than normal milk, the average being 0·580. This larger depression in the freezing point will not in any way interfere with the application of this test for legal work, as for quality control only the minimum value is of importance.

(iv) *Effect of season:* The values for the freezing point of milk from different breeds of animals studied over a period of one year did not reveal any change which could be ascribed to the change in the seasons.

(v) *Effect of separation and boiling:* Separated milk, prepared from the same samples of whole milk gave identical freezing point. This, as already indicated, is due to the fact that milk fat which is in the form of an emulsion does not contribute anything towards the observed freezing point depression. Heating milk to pasteurization temperature had no effect on the freezing point. Boiled milk shows greater depression than raw milk and this value does not change on storing the heated samples.

(vi) *Effect of preservatives:* Preservatives enter into solution in the milk and, therefore, markedly alter the freezing point, the change depending on the nature of the preservative and quantity added. It is therefore desirable that samples to be tested by this method should not contain any preservative, and if at all they have to be stored, they must be kept in a refrigerator. If any preservative has been used its nature and amount should be known so that a correction can be applied for it.

Addition of preservatives and other substances like sugar, even in small quantities, markedly lowers the freezing point of milk. Hence if such foreign substances are added to milk their presence will not go undetected. If along with substances which lower the freezing point, say water is added to counterbalance the effect, such an addition will at once become evident when the sample is tested for the percentage of solids-not-fat and fat by the regular methods in use.

(vii) *Effect of acidity development in milk:* Development of acidity in milk increases the freezing point depression. It is, therefore,

essential that samples tested should be wholesome with acidity not exceeding 0·19 per cent lactic acid, and in addition should not give a positive boiling test at the time of testing. If these precautions are not observed, some quantity of added water will go undetected as the developed acidity has a tendency to mask the effect of such addition.

Detecting of adulteration with water

Experiments carried out in the laboratory show that addition of three per cent of water to milk is easily detected when the original freezing point of milk is not known assuming the minimum freezing point of milk to be —0·530°C. Tests carried out for fat and S.N.F. on the same samples of milk revealed the sensitivity of this test. For example a sample of cow milk gave fat 5·5 per cent, S.N.F. 9·47 per cent and freezing point —0·548°C. When adulterated with 10 per cent of water, the respective values were 4·90, 8·52 and —0·489°C. A survey of milk sold in the local market showed that nearly 75 per cent of the samples tested contained added water, though many of these gave normal values for fat and S.N.F. These results will illustrate the utility of the freezing point test for detecting adulteration with water.

It is hoped that the data presented here will help the public health authorities to prescribe this test for quality control work. Though the method is a little time-consuming and costly, it is only by the application of such a method which gives clear cut results, that the evil of adulteration can be successfully wiped out. It may also be added that like every other method the freezing point test has its weaker points, and the test should therefore be used as a supplement to the results of fat and specific gravity, and not to replace any quicker and useful tests.

POWER MAKING DEVICE INVENTED IN AUSTRALIA

IN recent years Australian farmers have invented or adapted a remarkable number of machines and devices to lighten labour or enable farm operations to be carried out more quickly or efficiently. There has been nothing makeshift about these inventions. Many of them have subsequently been accepted by manufacturers for regular production.

One of the latest and simplest of these devices has been designed by Mr. W. H. Tann, who farms at Beech Forest, in Victoria. It is a horizontal metal plate, fitted with a series of vertical tynes. It can be used to replace the blade on a bulldozer, from which it differs as a gardening fork differs from a spade.

In use, the tynes cut through the earth to a depth of 15 inches, and sift out buried objects without carrying away the topsoil. Its most obvious use would be in clearing land of roots after scrub had been burned off, but it might also prove of value in preparing rock-strewn land for cultivation with an ordinary plough.—*Australian Agricultural Newsletter*, No. AGN/254.

BIRDSFOOT TREFOIL

By M. R. PANIKKAR

FODDER problem is as important as food problem, and is considered as a part of the latter in all agriculturally advanced countries of the world. The need for increasing the acreage under fodder crops in India or supplementing the fodder resources has been expressed time and again. At present there are only 304·3 million tons of fodder available as against requirements of 608·5 million tons. The area of cultivated land available per head of bovine population in India is only 1·8 acres, as compared with 3·4 acres in Great Britain, 4·5 acres in New Zealand, 24·9 acres in the U.S.A. and 31·4 acres in Canada. Except for a few seasonal crops grown under irrigation, and which too are not available everywhere, there is no largescale fodder cultivation or pasture development in India. No serious attempts have so far been made to explore and exploit the indigenous sources of fodder and forage plants, nor, barring a few exceptions, for the introduction of suitable exotics.

The scheme for the collection of useful indigenous and exotic plants sanctioned by the Indian Council of Agricultural Research and worked in the Indian Agricultural Research Institute, New Delhi, is however believed to be a prologue for a full-fledged Bureau of Plant Introduction, which is a necessary organization in an agricultural country. Through such an organization it will be possible to procure and introduce into the country many valuable plants which are cultivated for fodder purposes and otherwise in other countries. The Birdsfoot trefoil (*Lotus corniculatus* L.) is one of these plants which is on the list of the Bureau of Plant Introduction. A semi-erect and another spreading varieties of the plant were obtained by the Indian Agricultural Research Institute from South America (Uruguay) and the U.S.A. (Montana) respectively for trial. Sowings were made in October 1948, but the growth of the plants were slow, and in six months they were hardly nine inches high. However, none of these varieties flowered till April 1949, though artificial illumination has since induced it.

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Distribution and characteristics

In this short note it is intended to describe briefly the main points of the plant, about which several enquiries have been received in the Indian Council of Agricultural Research. Strachey[1] noted this yellow flowered herb blooming in April-September at 4,000 to 7,000 feet above the sea-level in the rainy regions of the Himalayas, at Almora, and mentioned that its distribution extends eastwards to China and westwards to Britain. It is also reported as growing wild in the Punjab by Sampson[2]. It is a leguminous fodder plant of temperate regions, but with a wide range of adaptability to varied soil and climatic complexes. It is salt-tolerant and a variety *L. corniculatus* var. *tenuifolius* is reported[3] to have high salt tolerance and can stand high summer temperatures. However it grows in areas with low temperature and abundant rainfall, as well as in warmer climates with lesser rainfall. It is also useful for water-logged soils, particularly the narrow-leaved variety, and at the same time it is a good soil binder and is more drought-resistant than most of the shallow-rooted leguminous fodders. Another advantage with this plant is that it persists and flourishes at lower levels of fertility unlike many other forage legumes, produces good pasturage, alone or in mixtures, and provides fodder for late summer feed and autumn grazing[4].

1. Strachey, Richard (1906). *Catalogue of the Plants of Kumaon, etc.* Revised and supplemented by J. F. Duthie, p. 42., Lovell Reeve and Co., Ltd., London.
2. Sampson, H. C. (1936). Cultivated Crop Plants of the British Empire and the Anglo-Egyptian Sudan, pp. 105-6. *Kew Bull.* Additional Series 12, H. M. Stationery Office, London.
3. Ayers, A. D. (1948). Salt Tolerance of Birdsfoot trefoil. *Jour. Amer. Soc. Agron.* 40; 331-34.
4. McKee, Ronald (1948). A General View of the Leguminosae, pp. 711-12. Grass : *The Year Book of Agriculture*, 1948. U.S.A. Department of Agriculture, Washington.

It is a fine-stemmed leafy perennial, somewhat decumbent when growing alone, though fairly upright in thick stands. Leaves are sessile along the stems and have five leaflets varying in shape from linear to oval. Flowers are yellow and showy, borne on long flower stalks which carry several or more characteristic spreading pods resembling birds foot, which gave the name to the plant. The minute seeds scatter readily from pods. The root system of the plant is deep with tap roots and branching laterals.

Cultivation

For the cultivation of the plant, a good and firm seed bed is prepared and seeds are sown at ¼ to ½ inch depth at the rate of 5 lb. of seeds per acre when sown alone, but lesser in mixtures with companion crops. As the stem of the plant is weak, it is desirable to sow it mixed with a strong supporting grass to prevent lodging. At the same time plants offering excessive competition in mixtures, and definitely injurious to the crop, are to be scrupulously avoided. For pastures, this trefoil gives best results when sown with sward-producing grasses like Kentucky blue grass (*Poa pratensis*), Timothy (*Phleum pratense*) and Cocksfoot (*Dactylis glomerata*). However, even where growing conditions are favourable, and good soil preparations are obtained, the use of the companion crops in mixtures retards the seedling development, though their effect can be partly lessened by having a sowing a below-normal rate of the former. This legume is to be supplied at planting time with a special inoculam of symbiotic rhizobia different from that of the common rhizobia[5]. Its response to fertilizers resembles that of other legumes and as with most of them, fertilizers high in phosphate will increase yield and often can be used with advantage.

The plant flowers and fruits within four to five months. Harvesting it for hay is not difficult, but not so for seed. The seed ripens unevenly and shatters easily necessitating great care in handling to prevent its undue loss. Only 50 to 100 lb. of seed can be expected from an acre of the crop. The problem of pests and diseases is not serious, as the plant is not affected by them to any large extent.

Fodder value

Primarily used as a fodder plant, as other trefoils, it has high feeding value both as pasturage as well as for hay. Nitrogen, phosphorus, calcium, lignin and other nutrient contents are comparable to those in lucerne (*Medicago sativa*) for hay and white clover (*Trifolium repens*) for pastures. The cyanophoric properties, though varying, have in no case produced any harmful effects. Hydrocyanic acid poisoning has not been found where stocks are fed on this trefoil[5]. It also compares well in palatability with other legumes of similar nature and stage of maturity. This fodder legume seems to be particularly useful for providing late summer feed, as it remains green in the autumn for several weeks after the other legumes have been seriously injured and defoliated by frost. It is a good soil binder for anti-erosion purposes too. In trials for reclamation of seriously eroded wheat lands in the Andean regions of Venezuela, it is reported[6] to have developed satisfactorily. The deep root system together with laterals, branching profusely in the upper soil zone, appear to give definite advantage to the plant over a wide range of environmental conditions. It is a suitable species for water-logged areas too, and is considered as promising for renovation and maintenance of marginal and submarginal lands[5].

Though slow to establish, and may be seriously injured where unfavourable conditions exist during the sowing time, this trefoil is of special value for fodder because it is deep rooted and there is growth even in late summer. It is more drought-resistant than shallow-rooted legumes like the white clover. On the soils adapted to the cultivation of lucerne, the yield for hay of trefoil is lower than that of lucerne; but it is more persistent and gives higher yield of forage. Its soil lime requirement is less than for lucerne. According to Ayers[3] it compares favourably with alfalfa and appears better adapted to salinity and higher temperature than red, alsike, ladino and strawberry clovers. Unlike red clover (*Trifolium pratense*) which gives higher yield in the first year, but does not persist beyond that period in any appreciable quantity, birdsfoot trefoil persists and continues to

5. MacDonald, H. A. (1947). Birdsfoot trefoil (*Lotus Corniculatus* L.): Its Characters and Potentialities as Forage. *Memoir* No. 261, Cornell Universities Agricultural Experimental Station, U. S. A.

6. Rosevere, G. N. (1948). The Grass Lands of Latin America, pp. 198. *Bull.* 36. I. A. B. Aberystwyth, Great Britain.

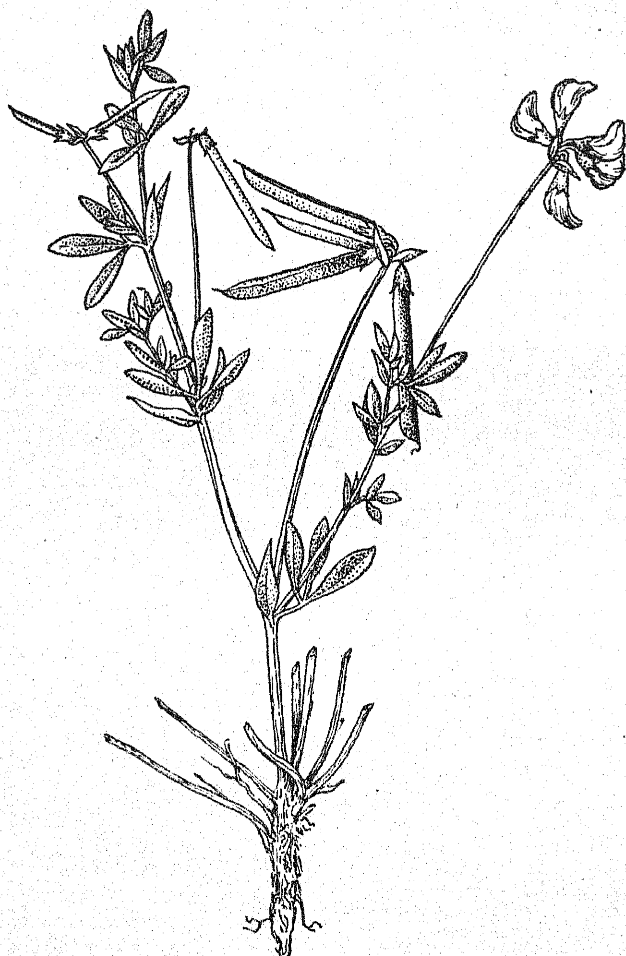

FIG. 1. Birdsfoot trefoil (*Lotus corniculatus*).

produce as a perennial. It also compares favourably with wild white clover. Though it cannot compete with such crops as lucerne or red clover for hay production on better soils, and under short rotation system of farming, it does present possibilities for hay and pasture production on secondary and poorer soils where lucerne is not successful, where red clover is too short-lived for the rotation used and summer conditions too dry for persistence of white clover.

Strains and varieties

Strains of this plant are variable and regional strains developed show marked differences with reference to habit of growth and adaptations. Perhaps these explain the initial unsatisfactory results of the trials with American samples at the Indian Agricultural Research Institute. Indigenous varieties from the Punjab and the United Provinces would, on trial, probably have given a quite different result. Nonetheless, selection and breeding are considered to be two of the most promising means of improving the crop.

There are a few more species under the genus *Lotus*, some of which too seem to have agricultural importance.

(1) *Lotus uliginosus* Schkuhr is the Big trefoil. Its seeds are bigger than those of the Birdsfoot trefoil. The roots have underground root stocks or rhizomes. But it is less winter-hardy, much less salt-tolerant than *L. corniculatus* var. *tenuifolius* and has succeeded only in regions with comparatively milder climate. However, it is widely grown in the wet pastures of South West Australia. In New Zealand it has been found useful in the improvement of marshy or peaty lands where other legumes failed to thrive.

(2) *L. angustissimus* Linn. is of European and North Asian origin and grown as a pasture plant on light swampy soils. It has been sucessfully introduced in West Australia.

(3) *L. australis* Andr. of Australian origin, is a valuable indigenous forage plant of the dry areas of Australia.

(4) *L. hispidus* Desf. of Europe and North West African origin is grown on lighter swampy soils of West Australia.

(5) *Lotus* sp: Many unspecified species of *Lotus* are of use as green fodder in Malta.

AUSTRALIA CLAIMS WORLD'S PUREST BEES

According to Australian apiarists the world's purest bees are at Kangaroo Island, South Australia. They are descended from swarms imported from Italy about 70 years ago and are the only bees of their type left in the world.

The bees were released on their arrival at Kangaroo Island and forgotten until a few years ago. Then the South Australian Department of Agriculture decided to breed them scientifically to retain the strain. Now five apiaries have been established which house about 30,000,000 bees, and a brisk trade has been established for their honey and for export of queen bees to various parts of Australia and to other countries.

Recently, three queens with 25 workers were sent to Egypt packed in small boxes measuring four inches long and half an inch deep. Boxes had three circular compartments which allowed the workers' movement but restricted the queens to the cells in which they were placed. The consignment travelled by ordinary mail and arrived safely.

Kangaroo Island bees are Ligurians and are in demand because they are quieter than the black bee. Slightly longer than the black bee, Ligurians have defined waspish markings.

In Italy, the Ligurian has crossed with other types and the purity of type has been lost.—*Australian Agricultural Newsletter*, No. AGN/254.

WATER CONSERVATION AND FLOOD CONTROL

By P. V. C. RAO

THE United Nations Economic Commission on Asia and the Far East had recently set up a Flood Control Bureau consisting of three to five experts whose business it would be to collect, correlate, and co-ordinate information and action programmes relating to the flood hazards in the Asian countries. It is also meant to facilitate training and exchange of experts between the various Governments. Its scope of operation is necessarily of an advisory nature on the problem of flood control without taking into account the wider problem of water conservation. It will have to be examined whether such a limited range of approach will help the solution of the problem in any effective manner.

A study of the history of floods would reveal that they are caused mostly by the rapid run-off of the rainfall and snow water at a rate exceeding the carrying capacity of the streams into which the surface waters of the watershed are discharged. When there is an excess of rainfall, the surface soil gets saturated quite soon with the resultant downpour running down the creeks into torrential streams that flood regions all around. In the absence of a cover of growing vegetation or a ground cover of vegetal litter, the rain striking the ground picks up fine particles of the substrata soil to produce a muddy suspension which closes soil pores, thus preventing further infiltration of water. Such premature saturation of soil and the consequent acceleration of the run-off occurs on the lands shorn of the woods and other vegetal cover. Widespread agricultural operations of unprotected fields on hazardous lines help rapid erosion of the porous surface soil and consequent exposure of the hard substrata. Creeks and gullies act with the same menacing force of rapidity as up and down furrows of slopy uplands. The streams gather in momentum while running down the plains with the added strength of the gutterflows. The barren watershed is thus the primary cause of valley floods.

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Land under cover of thick vegetal growth retards run-off and retains the optimum storage for slow infiltration by the soil. The vegetal cover also makes the land more cracky and absorptive. The early studies showing the relation of erosion control to flood control was made by George Marsh in the early seventies of the last century. He said in his book *The East as Modified by Human Action*: 'The felling of woods has been attended with momentous consequence to the drainage of the soil, to the external configuration of its surface and probably also to local climate, and the importance of human life as a transforming power is perhaps more clearly demonstrable in the influence man has thus exerted upon superficial geography than in any other result of his material effort'.

It is therefore no exaggeration to conclude that the decline of the Asian nations began with the utter destruction of the primal woods and grass lands. Vast stretches of plains had been stripped off their valuable soils by wind and water erosion and cancerous gullies defaced the entire landscape. Erosion and floods became interacting forces and brought about integrated ruination. The Central Asian plain and the Chinese valleys have been victims of cyclic floods engulfing entire regions. They should curse the past generations for their destructive play with the woods and the grasses.

Even in an advanced country like the U.S.A., efforts of flood control had till recently been confined largely to the construction of louvers, flood walls, flood ways, equalising reservoirs and similar devices in the larger streams. In other words, the main efforts to control floods had been confined to downstream by structures which provide emergency protection from the menacing effects of floods. Regarding the efficacy of such downstream engineering structures alone for the prevention of floods, Mr. Bennett, Head of the U.S.A. Soil Conservation Service, says: 'Flood control programmes to downstream installations do not provide the benefits possible in a more comprehensive attack on the problem, such as undertakes to conserve

rainfall in fields, pastures, and woodlands over the entire watershed. The purely engineering downstream plan overlooks the possibilities of conserving potential flood waters for useful purposes, on the land; it fails to consider conservation of the land itself and the necessity of preventing damage to downstream flood control works by the deposition of erosional debris'.

As a result of nationwide investigations conducted by the Water and Power Commission of the American Federal Government, the Omnibus Flood Control Act of 1936 provided for 'investigations of watersheds and measures for run-off and waterflow retardation and soil erosion prevention on watersheds' under the jurisdiction of the Department of Agriculture. Under the provisions of this Act, detailed investigations and surveys should be conducted by this department for the delimitation of the critical areas which are the nerve centres of the run-off streams in the whole watersheds. This involves a plan that provides for the integration of the various action programmes of the Department of Agriculture under the aegis of the Soil Conservation Service, and the employment of structural control measures by the War Department.

The Flood Control Bureau set up by the ECAFE should, therefore, take up under its purview a complete programme of Soil and Water Conservation which would provide not only an effective means of flood control but also scientific agriculture with optimum food output at substained soil fertility, and efficient forest regeneration and maintenance.

TECHNICAL AID FOR UNDER-DEVELOPED COUNTRIES

INDIA'S claim for technical assistance under President Truman's programme of aid to under-developed countries was pressed by the National F.A.O. Liaison Committee in India, at its first meeting held in New Delhi. It recommended that the Indian Delegation to the F.A.O. meeting should emphasize this point, in view of the urgent need for agricultural and industrial development of India. Mr. K. L. Panjabi, Agriculture Secretary, said that the announcement earlier this year by the U.S. President for technical assistance to under-developed countries raised hopes that technical skill and equipment would be available to India for nation-building activities. This matter, he added, was discussed at various meetings of the specialized agencies of the United Nations, namely, the FAO, the ECOSOC, the ILO and the WHO and the impression gathered was that about 35 million dollars would be contributed by the U.S.A. Government for this purpose. But recent information from the ECOSOC, which was the coordinating authority for such aid, indicated that a much smaller amount would be available. Emphasizing India's claim, he said that India did have certain amount of technical knowledge and skill in carrying through nation-building activities but her main difficulty was lack of necessary mechanical equipment; for example, the 'know how' of plant protection work was available in India, but the main difficulty was lack of equipment, machines and insecticides to undertake operations on a large scale.

Discussing the International Rice Commission's Report, the Committee recommended that the Indian Delegation should obtain information on advance methods of production in different countries and suggested that exchange of experts would be a useful move in this direction. Provision of irrigation facilities and adequate storage arrangements were particularly emphasized.—*Food Bulletin*, September 19, 1949.

What the Scientists are doing

THE MEDICINAL PLANTS AND FOOD POISONS INQUIRY

A SUMMARY of the main achievements of 'The Medicinal Plants and Food Poisons Inquiry' over which the Indian Council of Agricultural Research has spent about Rs. 1,28,634 during the twelve years of its existence is given below :

This Scheme has definitely advanced the knowledge with regard to the pharmacopoeial and allied drugs growing in India, and in this way has brought them into increased use in the manufacture of preparations used in ordinary medical practice. It has helped to develop the drug manufacturing industry in this country on sound lines, which is the only way in which the masses of India, whose economic condition is low, can get medicinal preparations at prices commensurate with their means. A number of manufacturing firms have come into existence and instead of concentrated extracts which were formerly imported, diluted and bottled, practically every kind of galenical preparation, powders, etc. are now being manufactured in India from materials produced in the country. The growth of pharmaceutical industry has, in its turn, stimulated the manufacture of solvents such as alcohol, chloroform, ether, benzene and many coal-tar products used in medicine.

The demand for indigenous raw material has increased and the area of drug cultivation has increased side by side. Examples of drugs which have been brought into extensive use are belladonna, digitalis, hyoscyamus, squills, colchicum, gentian, artemisia, juniper, velarian, podophyllum, colocynth, ephedra, pyrethrum, etc. Raw materials of good quality are now more easily available at reasonable prices, and the export of crude drugs from India, e.g. belladonna, ephedra, podophyllum, chaulmoogra, castor oil seeds, etc. has considerably increased.

This Scheme has helped actively in the systematic study of the poisonous plants growing in India. This work is of considerable importance not merely from the point of view of medical practice, but also from the point of view of the veterinarian and poisoning of the livestock. It is also of great economic significance. The toxicological aspects of plants in common use such as *Aconitum, Barringtonia, Calotropis, Nerium,* etc. have been worked out and a much needed note of warning against their indiscriminate use by the unqualified indigenous practitioners has been sounded. The survey of this group has been completed and the monographs on the poisonous plants of India will serve as a guide and as a basis for future work to those interested in this field.

This Scheme has investigated some common food poisons of this country such as *khesari dal* (*Lathyrus sativus*), Indian millet (*Sorghum vulgare*), *sialkanta* seeds (*Agremone mexicana*), etc. which have been responsible for producing serious outbreaks of poisoning amongst man and animals. Only fringes of this vast problem have so far been touched ; much important work remains to be done.

A survey of the Indian medicinal plants was carried out and localities of distribution of important medicinal plants such as the pharmacopoeial drugs of vegetable origin and their substitutes growing in India have been worked out. This work will be of value in harnessing the indigenous drug resources of the country.

A herbarium of Indian medicinal and poisonous plants dealing with about 1,800 species and 10,000 sheets has been established. Such a herbarium is essential for proper identification of medicinal plants for purposes of

research, and collection for manufacturing purposes.

This Scheme has done much to prove or disprove the therapeutic value of many drugs used in the indigenous medicine by the application of modern methods of chemical, pharmacological and therapeutic research. Of the drugs which have proved useful, the examples of *Adhatoda vasica*, *Plantago ovata*, *Holarrhena antidysenterica*, *Rauwolfia serpentina*, *Psoralea corylifolia*, *Saussurea lapa*, etc. may be cited. These and a number of other drugs which have been sufficiently worked out have been admitted in the Indian Pharmacopoeia List which was recently composed and published by a Committee appointed by the Government of India. This list in the first instance forms an addendum to the British Pharmacopoeia and will serve as a basis for the future Indian Pharmacopoeia. On the other hand a number of drugs which were in the old addendum have been shown worthless and deleted.

The contributions of this Scheme in the field of medicinal plant cultivation are none the less important. India is an emporium of all kinds of medicinal herbs and drugs, and, with suitable opportunities, she could not only meet her own demand but could have a large residue for export. The work has stimulated the cultivation of medicinal plants under suitable conditions of soil, season and climate in order to obtain the maximum quantity of active principles. In this way cultivation of important drugs such as digitalis, ipecacuanha, pyrethrum, etc. has been encouraged.

This work has led to the publication of the Monograph of the Poisonous Plants of India* in two volumes and a very large number of scientific papers. These provide a much needed information about the medicinal and poisonous plants o India.

*In the press. Part I is to be released shortly.

This Scheme has helped different Provincial Governments, Indian States, agriculturists and private individuals with advice on various aspects of the medicinal plants. It is this work which has given an impetus to research on Indian medicinal plants in many places. Investigations have been started in various universities and colleges, in centres such as Calcutta, Bombay, Dacca, Patna, Allahabad, Lahore, Madras, Trivandrum, etc. The educated people are realizing that the old systems are out of date in many respects, that many drugs used by them are not effective, and that the wholesale revival of them will not be to the best interests of India.

And last, but not the least, it may be emphasized that this Scheme has been instrumental in developing a well-trained personnel for carrying out research of this kind in this country. It should be remembered that the introduction of new medicinal agents from the claims of the indigenous materia medica is not an easy task, and requires close cooperation of botanists, chemists, pharmacologists and clinicians, and such an organization was built up for the first time, after years of patient work. It is a great pity that the Medicinal Plants and Food Poisons Inquiry has now been brought to an end and thus the botanical unit has been dispersed. Although a good deal of basic work on medicinal and poisonous plants has been done under this Scheme, a thorough and comprehensive study of all these plants is the work of many years, perhaps of some generations. It should be remembered that on the one hand that the indigenous system of medicine ministers to the needs of about 80 per cent of the population of this large country and on the other hand, on the poisonous plants side also, the cattle population of India is perhaps the largest of any other country in the world and mortality from this cause is very high at present. (R. N. C.).

You ask We answer

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and States. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. We know of cow-dung being used as a manure in our country. What other organic wastes do you mean which can be converted into manure ?

A. In the villages in addition to cow-dung, cattle urine, crop residues like *jowar*, wheat, paddy stalks, household wastes, kitchen ash, and village refuse matter can be converted into organic manure. In the towns there are large quantities of *katchra*, night-soil, slaughter-house wastes, etc. which by a simple process can be fermented and converted into what is called 'compost' The urban population in India has now increased to about 100 millions. By a proper utilization of the refuse materials, available in nearly 4,223 lakh tons in India, it would be possible to prepare nearly 100 lakh tons of good quality compost which can go to increase our food production by about 150 to 200 lakh maunds per year.

In addition to town refuse plenty of sewage, sullage and sludge at present goes to waste in our cities. The total quantity of sewage produced in those of our towns which are fitted with underground sewage is estimated at about 500 million gallons per day. The sewage is rich in nitrogen and other plant nutrients and the loss under this head alone amounts to an equivalent of 182,500 tons of ammonium sulphate valued at Rs. $5\frac{1}{4}$ crores per year. The above 500 million gallons of sewage per day can bring under irrigation an additional 360,000 acres of land and increase the production by 36 lakh maunds per year.

The Indian Council of Agricultural Research have been carrying on investigations for several years past, with a view to devising suitable methods whereby the above refuse materials could be employed for increasing our food production, without creating any nuisance or danger to public health. As a result of these investigations, satisfactory methods have now been worked out, whereby town refuse could be converted into useful compost resembling farmyard manure in appearance and properties. Sewage could also be used for irrigating land, and increasing food production in such a manner that it does not endanger public health. For this purpose, root-vegetables and low-lying crops, especially those eaten raw, should be avoided, but other crops which are processed and cooked, e.g. cereals, fruits, sugarcane, etc. may be grown with safety. In order to keep the soil in good condition, it would be necessary to fix a proper rotation of crops in the land treated with sewage, e.g. a wet crop like rice or sugarcane or heavy fodder may be grown followed by a comparatively dry crop like *jowar, bajra*, maize, etc. followed in some cases by fallow, where the land is on the heavier side.

By introducing properly worked out schemes of compost preparation and sewage irrigation, not only could food production be increased appreciably, but the Municipality can recoup in full the heavy expenditure it has to incur at present for the disposal of its refuse.

In view of the general apathy shown by Municipalities, however, in the matter of converting their refuse into manure, a certain amount of compulsion is necessary in the matter. Legislation to modify the Municipal Act so as to empower Government to compel Municipalities to convert their refuse into compost manure has already been passed in the Central Provinces and Berar and is now under consideration in other provinces like Bombay, East Punjab, Bihar, West Bengal, etc.

At present nearly 700 Municipalities out of a total of 4,000 are preparing compost at the rate of about 750,000 tons per year, but it is expected that during the year 1949-50, the production rate would be nearly doubled. Big cities like Calcutta, Bombay, Madras and Delhi alone can from their several years' accumulated stocks supply nearly one million

tons of manure, if proper arrangements for the transport and distribution of the manure by motor trucks and by railway wagons be made.

In order to accelerate the production of compost manure in the country, the Government of India appointed, in March 1948, a special committee known as the Central Manure (Compost) Development Committee with powers to review the progress of compost work in different areas, to prepare fresh schemes for expanding the work and to carry out intensive propaganda to achieve the objects of the Committee. The above Committee held its second meeting at Jaipur in December last during the Congress Week and made a number of recommendations, including one fixing definite targets of increased manure production for each area. In order to carry out the above recommendations of the All-India Committee, Provincial Compost Development Committees have been formed in different parts of the country which have held frequent conferences and meetings and a compost drive has been started throughout the country. It is expected that as a result of this drive, enough manure would become available in the country which would make the country ultimatley self-sufficient in the matter of food*.

*From the summary of a talk given by Sardar Datar Singh from the Delhi Station of All-India Radio on 7 April, 1949. Published with the kind permission of All-India Radio.

URBAN CLASSES TO HELP IN FOOD PRODUCTION

THE Agriculture Minister in an appeal to the urban residents of Bombay has urged them to help in the food production drive by doing actual work in the fields at least one day in the week. He called upon willing workers to register their names with the appropriate authorities.

The Hon'ble Mr. B. G. Kher, Premier, in a statement endorsed the appeal of the Agriculture Minister and said: 'I consider this to be an excellent opportunity for all young men and women irrespective of their political and other ideologies to bend their energies to this most urgent task before the country.' Mr. Kher added: In a national crisis like the present one, everyone must work and it was only reasonable to expect that the urban population also should contribute their spare time to the production of food in the villages on which they subsisted.—*Food Bulletin*, September 19, 1949.

What's doing in All-India

INCREASED PRODUCTION OF 44 LAKH TONS OF FOODGRAINS

THE Government's four-point plan to increase foodgrains production in India by nearly 44,00,000 tons by the end of 1951, was outlined at a Press conference* addressed by Mr. R. K. Patil, Commissioner of Food Production. Of this additional increase, 36,10,000 tons were to be secured through intensive cultivation, 3,00,000 tons from the reclamation of weed-infested and new lands by means of tractors, 2,60,000 tons through tube-well irrigation and 2,30,000 tons by the diversion of the acreage under sugarcane to foodgrains.

Discussing the reasons for the contradiction between the intentions and the achievements of the 'grow more food' campaign which had been in operation during the last four years, Mr. Patil recognized that the Central and Provincial Governments had to share part of the blame. There had been some increase in this food production during the last few years, but that was a result of the country's general development programme. The 'grow more food' campaign had succeeded to the same extent, as our other development programmes. 'So far there has not been that development of a special will which alone can ensure success in war on the food front. That can only come when there is a definite objective and a clear-out programme, which has to be carried through with vision'. The administrative machinery left by the previous Government was admirably suited for the maintenance of the *status quo*, but it had now to be geared to the new needs of producing sufficient food for the country within the next two years. During this period every other interest and plan had to be subordinated to this single aim. During the last war, despite the passive hostility of the people, the British Government in India did achieve some success in the war effort. If the present food crisis is fought on a war basis, success is assured, for instead of hostility, the Government has the willing support of the country. But for this it is necessary to create an atmosphere of urgency in the urban areas before it can percolate to the villages. If the cultivator is to be enthused for growing more food as a patriotic duty, that duty must be first discharged by those who have a better conception of patriotism than the cultivator. If during the period of the war, high civilian officers and prominent non-officials could be singled out for Government displeasure for not making their contribution to the war effort, there is no reason why men at the top should not be subject to opprobrium, if they fail to make their contribution during this period of national crisis.

Provincial machinery

There will be a sub-committee of the Cabinet in all provinces charged with the responsibility of successfully carrying out the 'grow more food' campaign. It will consist of the Premier and the Provincial Ministers of Finance, Agriculture and Irrigation. Its chief executive officer will be the Director of Food Production, who will be in charge of increasing production, in the same manner as the Commissioner of Food Production is at the Centre.

Measures of intensive cultivation

Intensive cultivation measures will assume the supply of (1) more manure, (2) better seeds and (3) more water for irrigation. One of the reasons for higher yields of crops in the more advanced countries of Europe and America, and even in China and Japan, is the larger application of organic and inorganic manures. There is enormous scope in India for the use of natural organic manure. It is estimated that nitrogen derived from the residents of

* At New Delhi on 9th August, 1949.

Delhi, for example, is sufficient to fertilize a minimum of 40,000 acres of land. Another rich source of manure is cattle dung and cattle urine. Composting has made some progress in recent years, but even so only 686 municipalities out of a total of 4,000 are working on such schemes, and the total annual production of compost is estimated at 705,300 tons, which is only seven per cent of India's capacity. To grow more food from the soil, more soil food (manure) must go back to it. One of the most important measures in the Government's increased production plan therefore, is to launch a compost drive, both in the urban and rural areas. The problem has an administrative and a psychological aspect. In the first case, various administrative measures will have to be taken to ensure that the whole government machinery is concentrated on this idea, and in the second case, the villager's prejudice against the use of this type of manure will have to be overcome, as has already been done in some municipal areas.

As regards chemical fertilizers, which India is getting from abroad, and is also manufacturing to a limited extent, there is unanimity in the view that their use without a *humus* base of organic manure is disastrous for the soil. As we are having 5,00,000 tons of chemical fertilizers, this is an additional reason for producing our own organic manure as much as possible.

Water for irrigation

The largest single factor responsible for a satisfactory crop is timely and assured water supply. It has been often stated that if India could utilize all its rain water, it would be a land of plenty. The problem is not that the total precipitation of rainfall is insufficient, but that its distribution is uneven and erratic. This problem the Government plans to solve through concentrating on small irrigation schemes of surface wells and tanks, and the bunding of small *nullahs* and tiny streams.

Seeds

India's 59 million acres under rice and 25 million acres under wheat need about 2 million tons of seed paddy and 0·9 million tons of seed wheat. In addition to the existing schemes of distribution of good seed to the cultivators, the Government are examining a scheme of educating the villager to make his own seed selection. This will result in a substantial increase in the crop outturn.

Land reclamation

India is expecting a substantial loan from the International Bank for her schemes of land reclamation by heavy tractors. The target of land reclamation during the next two years is 8,00,000 acres which will bring in an increased production of 3,00,000 tons of foodgrains. During the current year, 100,000 acres of land have already been reclaimed, and the result of the experiment with old machines fully justifies an expansion of the scheme. Not only have the total costs of cultivation been met by the bumper harvests reaped, but there have also been substantial profits.

Production-procurement link

All constituent units have been addressed to enact legislation to bring fallow lands under cultivation and to link up increased production to increased procurement. The Central Government have suggested that at least 60 per cent of the increased production from grow more food must be procured by the respective Governments.

Inducements for increased production are to be offered to villagers on a cooperative as well as on an individual basis.

The areas chosen for increased production are to be concentrated in those districts or parts of districts, where there are facilities for irrigation or which enjoy normal rainfall.

Grants to provinces

The Government of India have reviewed the position governing the assistance by them to the provinces for implementing their development plans, in the context of anti-inflationary measures, the resources available to the Centre in the current and the ensuing years, and in the light of discussions at the recent Provincial Finance Ministers' Conference. They have decided that the grants and loans to the various provinces for expenditure on approved development and 'grow more food' schemes should be as follows :

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Province		Grants 1949-50 development and 'grow more food' schemes	Loans 1949-50
		(Figures in lakhs of rupees)	
Madras	...	5,00	6,00
Bombay ...	...	2,27	...
U.P. ...	...	5,17	4,00
Bihar ...	...	4,00	...
C.P. and Berar	...	1,80	3,00
West Bengal	...	2,70	...
Orissa ...	...	1,35	2,00
East Punjab	...	1,50	10,00
Assam ...	...	1,25	3,25
Coorg ...	...	6	5
		25,10	28,30

They have decided that grants to the provinces should be limited to 50 per cent of the expenditure incurred by the Provincial Governments on development schemes including the 'grow more food' schemes, and certain training schemes approved by the Government of India. But in the case of the provinces of West Bengal, and East Punjab, which have been affected by the partition, and Orissa and Assam, which are relatively less developed, the entire expenditure on approved schemes will, for these two years, be reimbursed, as a special case, subject to the maximum amount indicated above.

Provinces are at liberty to transfer any amount for the development programme to 'grow more food' schemes. Lack of funds cannot therefore be an excuse for a failure of the scheme.

The complaint in the past has been that though a large amount of money was spent on the 'grow more food' campaign, it was not known what it had produced. There were no statistics. We have already strengthened the statistical organization at the Centre and asked the provinces to do likewise.

Subsidiary foods

An essential and important part of food production is subsidiary food. The inportance of this will be appreciated from the fact that from an acre of land, 548 maunds of potatoes can be produced under very favourable conditions, while 25 maunds of wheat can be produced with good irrigation. And the land which can grow irrigated wheat is generally also favourable for growing potatoes. We usually import potato seed from abroad and spend foreign exchange. This can be curtailed, if not completely saved, by growing more potatoes. The same applies to other subsidiary foods.

We also propose to indicate to the people the best way of storing foodgrains so that losses on account of storage are reduced to a minimum.

Crop protection

So far the interests of crop protection have been subordinated to those of preservation of law and order with the result that crop protection has suffered. It will be our purpose to reverse this process now. The first step to secure this will be to see that licences for arms are given freely to cultivators or to their nominees. The latter are frequently persons who are professional *shikaris* or belong to a caste whose ancestral profession is to kill wild animals.

In areas where the damage to crops is serious, special efforts will be made to form crop protection societies on the part of cultivators and they will be provided with fire-arms. Linked with this question of crop protection is the question of catching wild animals, like wild cows, which are rampant in particular areas and damage crops. A method of catching these wild animals is being practised and demonstrated in Mathura District. Arrangements have been made to train provincial candidates at this centre.

All party programme

While the Congress, because of its past history and achievements, has a special responsibility in winding this war against food shortage, it can only be fought to a speedy and successful end by the willing cooperation of all parties in the country. This is a programme in which all Indian parties and interests without the sacrifice of any of their political ideologies, can unite to ward off a common danger.

The question is, shall we, as a nation, rise by each one of us doing his duty in this total war on the food front ? Our slogan is 'Produce More Food', and 'Waste No Food'. I have no doubt, that the task, though difficult, can be successfully accomplished, if the right atmosphere is created. And herein the Press has to play an important part of making the nation fully war-conscious. If that is achieved, everything else will follow. (*P.I.B.*)

COCHIN

N. SANKARA MENON

THE 'Kole' and 'Puncha' paddy crops cultivated during the period January-April suffered to a great extent due to the drying up of all sources of water and the complete absence of thunderstorms during the month of March 1949. Of the total area under cultivation, namely about 20,000 acres, normal yield was obtained from only a small portion and the crop completely dried up in certain places. An intensive campaign on manuring these crops was conducted by the officers of the Department and the liberal subsidy of 50 per cent on the selling price of manures granted by the Government induced cultivators to manure their crop on a large scale. The failure of the crop over a large area was a blow to the cultivators in that they lost the amount spent on manuring also. Steps were immediately taken by the Government to prevent the recurrence of such a catastrophe and a conference of cultivators and officials was convened under the chairmanship of the Hon'ble the Prime Minister of the State. The measures to be taken to ensure a satisfactory supply of water to these crops were discussed and action is being taken on the proposals placed before the conference. Water will be stored in suitable places to irrigate the crop in case thunderstorms fail during the growing period.

Subsidy on manures

Since the food situation in the country has not materially improved, the subsidy of 50 per cent sanctioned on the selling price of manures used for 'Puncha' and 'Kole' paddy crops was extended to manures used for the first crop of paddy locally called 'Viruppu.' Vigorous propaganda is conducted to induce all cultivators to manure the 'Viruppu' paddy crop. Rainfall is almost normal and well-distributed and the crop is coming up well. Manuring may show very good effect if the monsoon continues to be favourable.

N. SANKARA MENON, B.A., B.Ag., is Manure Officer, Trichur.

Green manure crop

To induce cultivators to grow green manure on a large scale especially for the paddy crop, a subsidy of 50 per cent on the selling price of green manure seed is sanctioned by the Government. Seeds are distributed on a large scale and it is expected that a large area under paddy will be manured with green manure. The exact quantity of seed distributed can be ascertained only after the season is over. Green manure plants are distributed on a very large scale at a nominal price from the Government Central Farm.

Production of compost

The preparation of this valuable manure in the Municipal areas was taken over by the Agricultural Department and the whole work was put under the charge of a full-time officer. The work is now in progress in five Municipalities and one small town where the sweepings and night-soil are collected by the *Panchayat* and Public Health Department respectively. Only three months have passed since the work was undertaken by the Department and therefore the manure under preparation can be used only after some time. Small quantities which have decomposed satisfactorily are being sold now. The scheme will be extended to the other Municipalities also within a few months and provision for this has been made in the next year's budget.

The Government have also sanctioned the 'Village Compost Scheme' for the preparation of compost in households and farms by utilizing sweepings and cattle dung. A subsidy of one rupee per ton of compost manufactured is sanctioned. The question of giving a subsidy of Rs. 2-8 per 100 c.ft. of trench for preparing the compost is under the consideration of the Government. A large quantity of compost can be prepared in the State if the subsidy mentioned above is sanctioned. The Departmental Officers are making their best efforts to see that all available organic refuse is converted into very valuable manure.

Grow more food schemes

The Cochin Government have under consideration several schemes to make the State as self-sufficient in food as possible and these schemes were discussed at a meeting held at Trichur on 16 May 1949, at which the Hon'ble the Prime Minister of the State presided. The measures included three major irrigation schemes and a few minor irrigation works. The three major irrigation schemes are the Peechi Scheme, the Chalakudi River Diversion Scheme, and the Wadakkancheri River Valley Scheme. The Peechi Scheme is estimated to cost Rs. 150 lakhs. About 12,000 acres of dry land can be converted into wet land for growing paddy. Four thousand acres of single crop land can be converted into double crop paddy lands and the water in the reservoir will be useful for about 10,000 acres of existing paddy lands in case the monsoon fails. The water can be used for the 'Kole' and 'Puncha' paddy also whenever there is necessity for the same. The Chalakudi River Diversion Scheme is estimated to cost Rs. 72 lakhs. When the work is completed, about 11,000 acres of dry land can be converted into paddy lands. Four thousand acres of single crop land can be converted into double crop lands and it can benefit 6,000 acres of existing double crop and 3,000 acres of single crop lands. The Wadakkancheri River Valley Scheme is estimated to cost Rs. 25 lakhs and will bring 5,000 acres of new area into double crop paddy lands besides benefiting 3,500 acres of existing paddy lands.

Besides the above work, it is proposed to clear an area of 25,000 acres in the forest for the cultivation of food crops. A tractor unit is working for this purpose.

Intensive cultivation also is to be taken up to increase the production of food crops and for this purpose, a liberal subsidy will be given on the selling price of manures. The distribution of high yielding strains of paddy will be taken up on a very large scale. Green manure seeds will be procured and distributed at half the cost price. It was also proposed to spend about Rs. 10 lakhs for minor irrigation works.

The above schemes when completed will solve the food problem of the State to a very large extent.

PATIALA AND EAST PUNJAB STATES UNION

RANBIR SINGH

THE Patiala and East Punjab States Union was formed on 20 August, 1948. The staff of the Agricultural Departments of the covenanting States have been integrated, which forms a big unit as compared to that of individual States. The main activities of the Department since the formation of the Union are briefly described below.

Veterinary Department

This Department is under the control of the Director of Agriculture. The Union Government have sanctioned the posts of one Veterinary Superintendent, four Deputy Veterinary Superintendents, 25 Veterinary Assistants with the necessary compounders and other subordinate staff. Funds for medicine to render help to the cattle of the Union have been placed at the disposal of veterinary hospitals at suitable centres. This scheme will go a long way to save the cattle of rural people from epidemics and other contagious diseases. The full complement of staff have been appointed and the work of the Department has commenced.

RANBIR SINGH, B.Sc. (Agri.), is Assistant Director of Agriculture, Bhatinda Circle, Faridkote.

Cattle Improvement and Insurance Scheme

This Scheme has been sanctioned in co-ordination with the Indian Council of Agricultural Research, New Delhi the cost being shared on a 50 : 50 basis. The Scheme is under the charge of Dr Mohinder Singh. The object of the Scheme is to improve the cattle of the

villages and to improve the milk supply of Patiala city with insurance against death, etc. The villagers are being advanced money for the purchase of good cattle to begin with, in order to make the Scheme a success.

Land reclamation

A detailed scheme to reclaim about 2 lakh acres of land in the first year has been worked out and sent to the Government of India for raising loan from the World Monetary Fund. The Union Government have purchased six tractors through the Government of India and have issued them to very big landlords in different centres to work on their lands in order to increase the production and give an impetus to the grow more food activities within the Union.

Agricultural development

The posts of Agricultural Botanist and Agricultural Chemist have been sanctioned. A detailed scheme for a research and experimental farm has been prepared for the sanction of the Government. Similarly schemes for improving dairy cattle, for increasing the water supply in the existing wells by boring, and for sinking of tube-wells, etc. have been chalked out and are awaiting the sanction of the Union Government. These schemes are in connection with the 'grow more food' campaign. Some of the schemes are expected to come into operation very soon.

Supply of improved seeds

The Union Government has sanctioned about Rs. 2 lakhs in the current year's budget to meet the increasing demand for improved seeds from the public. This aims at increasing the yield per unit of area of important cereals and other foodgrains. There are great potentilities of agricultural improvements and developments within the Union.

TRAINED PERSONNEL FOR IRRIGATION SCHEMES

"THE crisis is an immediate one and any scheme which provides for food immediately should receive priority over schemes that have a longer range value'. In these words, the Central Ministry of Agriculture has made a suggestion to all provinces and States to divert to the maximum possible extent, the available engineering staff to grow more food work.

Because of the paucity of trained personnel, the provinces have, in the past, found it difficult to implement fully their minor irrigation schemes, which are of great importance in the programme of intensive food production in the provinces. The greatest difficulty is being felt at the level of overseers and supervisors. A few suggestions have been made by the Agriculture Ministry to meet this difficulty to some extent. First, that schemes other than those relating to food production, which need the services of engineering staff, such as roads and building works should have second priority; and secondly, to examine the possibility of arranging with the Universities that the practical training in the Engineering colleges might form part of the work done in the field, so that students could be released after their pre-practical course is over. It is felt that this practical training would be of greater use than that given in the colleges on the pilot scale. The third suggestion is that a six months' course in survey and execution of small works should be started, which would enable candidates to survey, prepare plans and estimates, and undertake the routine execution of small works.—*Food Bulletin*, September 19, 1949.

'Across the Borders

DISEASES AFFECTING YOUNG CATTLE

By A. R. GRAYSON

ANY disease affecting young cattle, and resulting either in death or unthriftiness, represents a serious economic loss to both the individual owner and the community. Where death does not occur, the time and labour involved in nursing and treating the sick animal represents a serious drain on the limited labour available. These disease conditions, however, can often be controlled by attention to hygiene, and in some cases disease can be prevented by calfhood immunization. This latter method, in particular, is strongly recommended, representing a direct financial saving, as well as saving of labour.

Scours in calves

White scours: The term 'white scours' indicates the chief symptom of a serious disease in young calves, which is common in the dairy herds of this State. It is a form of diarrhoea occurring usually within two or three weeks after birth, and is due to organisms of the Colon type. Infection usually takes place by way of the mouth, but an unhealed navel may afford a means of entrance. The disease runs a fairly rapid course, and is fatal in a large percentage of cases. In some instances, where recovery does occur, secondary infection, i.e. arthritis, may arise. Surviving animals remain weak and stunted for a considerable time.

Symptoms may occur within a short time after birth, or may not develop for 10 or 12 days. A very profuse liquid diarrhoea is set up, generally yellowish-white in colour, often curdy or frothy, and sometimes blood-stained. The faeces are generally offensive in odour, and their passage is accompanied by straining, grunting or moaning. Emaciation is rapid. The tail region becomes badly soiled, and the calf presents a miserable picture; eyes sunken, belly tucked up, back arched, hair stiff and dry. The temperature is raised early, but as the condition progresses the temperature may become sub-normal, as evidenced by a coldness of the extremities.

Blood scours: In older calves, diarrhoea with foetid blood-stained faeces may develop. This condition is commonly known as 'blood scours' and is due to enteritis caused by bacterial infection. As the condition develops, a picture resembling that described above is presented.

Treatment

Treatment consists first in the isolation of the sick calf to prevent the spread of infection. It should be placed in clean, bright, well-drained and well-ventilated, dry surroundings, or in a sheltered, well-drained yard or paddock. All food should be withheld for one or two days, and a liberal supply of cooled boiled water given every four hours. In some milder cases, this will be sufficient to remove the irritating material causing the diarrhoea, and recovery occurs. In other cases, particularly in older calves, it is advisable to dose with castor oil (1 to 3 oz. according to the size of the calf) in an attempt to remove the irritating material, which often consists of undigested clots of milk. This should be followed with an internal antiseptic. Perhaps the best to use would be formalin, which, besides being an intestinal disinfectant, also prevents bloating. The dose according to size is ½ to 1 teaspoonful given in ½ pint of boiled milk. This can be repeated daily. If the diarrhoea still persists, astringents such as bismuth subnitrate 1 dram, gum arabic 1 dram in boiled milk given three times daily, *or* powdered opium 5 grains, catechu 1 dram, and prepared chalk 1 ounce, given in gruel twice daily, may be administered.

Sulphonamide treatment

Certain members of the sulphanilamide group of drugs are highly efficient in controlling calf scours. In order of preference these are sul-

phamezathine, sulphamerazine and sulphaguanidine. Of the first two, an initial dose of 2 drams (16 half gramme tablets) per 60 lb. bodyweight is given, followed by a dram (8 half gramme tablets) per 60 lb. bodyweight given once every 24 hours.

The tablets are first crushed, and the resulting powder may be incorporated with the food or be given as an electuary with treacle or honey.

Sulphaguanidine for veterinary use is prepared commercially as a pink powder. The initial dose for calves is $3\frac{1}{2}$ grammes (1 level teaspoon and a half) per 50 lb. bodyweight, followed by $2\frac{1}{2}$ grammes (1 level teaspoon) per 50 lb. bodyweight, then 2 grammes at 6-hourly intervals until the scouring subsides.

With any treatment, it is important that the patient have access to an adequate clean water supply.

Prevention

Prevention, however, provides a much better line of defence than does curative treatment, and is more likely to yield better results. It consists in the first place in care and attention at the actual time of calving. In this respect, under Australian conditions, good clean pasture will provide the necessary hygienic surroundings.

On properties where the disease is known to exist, the navel of the calf should be ligatured and disinfected with tincture of iodine at birth or as soon after as possible. The most important line of control, however, is the care which must be given to the nutrition of the newly-born calf. It requires, and should get, its own mother's milk for at least the first few days. This first milk or colostrum has laxative properties, and, in addition, contains elements which assist the calf in resisting disease during its early life. Not the least important of these elements is the relatively high vitamin A content. Whole milk should be fed for the next few weeks. Separated milk should not be fed to the calf until it is three to four weeks old. The change from new to separated milk should be gradual, and a substitute for the cream removed by the separator should be provided. For this purpose 1 to 2 oz. daily of pure cod liver oil is probably the best. If cod liver oil is not obtainable the use of Apsolene or other similar fishliver product will prove satisfactory. The calf should not be overfed, and all milk should be fed at blood heat. More care in the frequency and amount of the feeds will do much to prevent digestive disorders. All feeding buckets should be scalded after each meal and preferably hung up in the open, exposed to sunlight.

The newly-born calf is susceptible to cold, and this necessitates the provision of adequate shelter. This usually takes the form of more or less permanent calf sheds and pens.

Essential points to be considered in the construction of calf sheds are:

1. They should be bright, airy and dry.
2. An impervious floor is essential, and the floor must be given sufficient fall for drainage. Disinfection and general cleanliness are thus rendered easier.
3. Plenty of bedding to provide a warm, dry bed in winter and a cool one in summer should be provided, and soiled bedding must be replaced regularly and frequently.

Calf pens or yards should be sufficiently roomy to provide plenty of exercise. They must be located so that they are not contaminated by drainage from other paddocks or existing sheds, i.e. cow sheds, pig sties, etc. The provision of a feeding rack to contain good quality meadow hay is desirable as this will tend to obviate any tendency to eat bedding. There should be a readily accessible supply of good fresh water.

Minerals are necessary for all growing animals, and milk alone, particularly when separated, does not contain a sufficiency of minerals for normal growth and development. To a large extent any mineral deficiency is overcome when the calf starts feeding on pasture, and this will be further aided by the provision of a suitable mineral lick such as dicalcic phosphate, bonemeal or bone flour 1 part to salt 4 parts. While being bucket fed, the addition of limewater to the milk at the rate of 1 dessertspoonful to 1 quart is of distinct advantage. Carron oil, which is made by mixing equal parts of limewater and raw linseed oil, may also be used.

It must be stressed that calves are born healthy, and that the relatively high rate of mortality is due, fundamentally, to errors in feeding and management, and, as such, are preventable. This particularly applies to 'scours' for outbreaks are intensified under conditions of bad management.

Ringworm in calves

Ringworm is a disease of the skin which may attack any domesticated animal, and also man. It is most frequently seen in young animals such as calves or yearlings which are in poor condition. The disease is contagious, and is caused by fungi of the family *Trichophyta*. These fungi consist of growing threads or hyphae, and have the powers of forming spores which are very resistant and may retain their power of germination for months.

Infection results usually from direct contact of healthy with affected animals, or it may occur in sheds or pastures through the medium of posts, etc. against which affected animals have rubbed themselves.

Lesions most commonly occur about the head, face and lips, eyelids and neck, although they may be found on any part of the body. The lesion commences as a raised ring-like patch on which the hair becomes at first erect, and later breaks off. This is due to the fungus becoming established at the base of the hairs. As a result of its penetration, epithelial scales become heaped up to form greyish-white or greyish-yellow crusts. The lesions are usually numerous and extend to the size of a five-shilling piece. They may become confluent, in which case quite large areas are involved. These crusts are at first firmly adherent, and, if forcibly removed leaves a raw bleeding surface. If left alone, the crust becomes raised by a slight purulent discharge, and may later be shed. The bare skin then exposed has a thickened and wrinkled appearance. The discharge on the bare patch often dries and forms a thin scab under which healing takes place, followed by a subsequent growth of new hair.

In adult cattle there is, as a rule, no systemic disturbance, but in badly affected young stock, general unthriftiness is, set up. The degree of irritation is variable, but in the majority of cases calves tend to rub themselves against gate posts and other obstacles, and thus set up centres of infection and re-infection. So, through lack of attention, ringworm may assume a chronic character.

Affected animals should be isolated. Calf pens, etc. from which affected animals have been taken should be thoroughly disinfected, particular attention being paid to the woodwork. Lime-wash containing carbolic acid, ½ pint to the gallon, may be used, and is most effective if applied hot.

Curative treatment in most cases is both simple and effective. The hair should be clipped from around the affected parts, and the crusts and scales removed. This may be done more easily if they are first softened by applications of olive oil. They may then be washed off with warm soapy water to which washing soda has been added. All debris removed should be carefully burnt.

Having cleaned up the affected parts and dried them, the lesions must be dressed with a parasiticide, of which there is a considerable choice. Probably ordinary weak tincture of iodine (2½ per cent) makes the best dressing. Other suitable dressings are equal parts of sulphurous acid and glycerine ; 1 part creosote to 7 parts raw linseed oil ; 2 per cent solution of formalin in water. Mercuric preparations such as mercuric ointment or corrosive sublimate are also very effective. These should not, however, be applied over large areas as calves are liable to be poisoned by mercury. Whatever method of treatment is adopted, it is important to remember—

1. That all diseased hair must first be shed or removed.
2. That a liberal diet is necessary.
3. That man can contract this disease from cattle. The attendant, therefore, should wear overalls while dressing an animal, and should disinfect his hands and arms afterwards.

Blackleg in cattle

Blackleg is an acute infectious disease affecting, chiefly, cattle between the ages of six months and two years. Younger and older cattle, however, may be affected, and sheep of all ages are also susceptible. The disease is more or less restricted to certain well-defined areas. Even in these areas the infection may be restricted to certain portions or even paddocks. River flats, low-lying pastures or swamps, etc. are often particularly dangerous.

Blackleg is caused by a bacillus—*Clostridium chauvei*—which is an anaerobe ; that is, it cannot exist in the presence of oxygen. The bacillus has the power of forming spores and these spores can remain viable for years. Contamination of pastures is greatly increased when infected carcasses are cut up or are not properly disposed of.

Animals do not infect each other directly, but pick up the infection from the soil, either by

swallowing infected food or water, or by contamination of a wound.

Symptoms

The period of incubation is usually about three days, and the disease runs a rapid course, death ensuing in from 12 to 48 hours. In many cases, no symptoms are noticed, the infected animal being found dead. When symptoms are seen, a sick animal often shows a lameness generally restricted to one hind leg. The animal separates itself from the rest of the herd, refuses to feed, and rumination ceases. The temperature is raised, being from 104 to 107 degrees, and the animal goes down. There is a blowing respiration often accompanied by grunting. On close inspection, a local swelling may be discovered most often in the upper part of the hind limb in which lameness was apparent. This swelling, however, may appear wherever there is a muscular mass, i.e. in shoulders, loins, chest, neck, etc. It is at first small, hot and painful, but rapidly extends, involving a larger area. Later the swelling becomes cold and insensitive. The skin in the area becomes hard and dry, and there is often a sharp line of demarcation between the diseased and healthy tissues. On manipulation, the swelling is found to be gas-filled and a peculiar crackling sound like the rustling of stiff paper is heard. This is due to the presence of gas in the swelling, the gas being formed in the tissues by causal bacillus. As the condition progresses, the breathing becomes more laboured, the animal becomes prostrate, the temperature falls to normal or sub-normal and death soon follows.

Post-mortem lesions

The characteristic lesion of blackleg is the gas-filled swelling which crackles on manipulation. If the lesion is cut, the muscles and other tissues are found to be dark red or black in colour, and more or less porous and dry-looking. This is due to the separation of the muscle fibres by the gas formation. The affected tissues give off a characteristic odour resembling rancid butter. A blood-stained discharge is given off when the muscle fibres are cut, and sometimes there are similar discharges in the pleural and abdominal cavities.

The frequent occurrence of the swelling in the upper portion of a limb has given to the disease the name 'Blackleg' or 'Black Quarter'. Occasionally, however, no external evidence of swelling is noticed, the lesion in these cases being found elsewhere in the carcass.

Treatment and prevention

Curative treatment is useless. Any attempt at such, by incision of the affected portion and the application of strong disinfectants, is to be condemned because of the certainty of spreading organisms which are very abundant in the liquid escaping from the cut surfaces.

As the spores of the organism can live in the soil, great care must be taken, as already indicated, to prevent any addition to the number already in the soil. Carcasses should not be skinned or unnecessarily cut up, but should be disposed of by complete burning. Cattle of susceptible age should be kept off known infected pastures and periodical burning of these infected pastures is a further method of prevention.

Vaccination

The only effective method of preventing the disease is by vaccinating calves before they reach the susceptible age, and the Commonwealth Serum Laboratories prepare a vaccine which is recommended for this purpose. It contains no living organisms, therefore it is quite safe, and it confers an immunity which persists during the susceptible period. A permit to obtain the vaccine will be supplied on application to the stock inspector of the district, and the inoculation, which consists of the injection of the vaccine (under the skin) can be carried out by the farmer himself. The usual precaution of clipping the hair and sterilizing the skin with tincture of iodine or methylated spirits before injection should be observed. The incoulation is made usually behind the shoulder.

A suitable hypodermic syringe and needle, with care, will last for years, so that the only expense each year is the cost of the vaccine itself.

Blackleg is a notifiable disease under the Stock Disease Act, and all outbreaks should be reported to the Chief Veterinary Inspector, Department of Agriculture, Melbourne, C.2.

All sudden deaths among young cattle, associated with lameness and the characteristic crackling swelling in the muscles of the limbs

should cause stockowners to suspect blackleg. In suspicious cases, in order that the diagnosis may be confirmed, a portion of the affected muscle—about 2 inches in diameter—should be placed in a screw-top jar, and this, securely packed, forwarded to the Director, Veterinary Research Institute, Parkville, N.2. A letter advising the despatch of the specimen for diagnosis and describing symptoms noticed, should be forwarded at the same time.—Reproduced from *The Journal of the Department of Agriclture*, Victoria, May, 1949.

COLD STORAGE FACILITIES INCREASE

ONE of the methods which is being actively encouraged by the Ministry of Agriculture to prevent wastage in foodgrains, seeds and other perishable food is the provision of refrigeration facilities and assistance is being given to private enterprise to set up cold storage plants in different parts of the country.

As a result of assistance given during the last two years the number of cold storages in the country has risen from a bare dozen in 1947 to about 50 during this summer season, with a capacity of 500 tons each. With the intensification of the Grow More Food drive, greater assistance is to be given and it is hoped that by the summer of 1950 the country will have about 100 well-equipped storages with a total capacity of storing about 12 lakh maunds of perishable food and seeds. The actual quantity stored in these units will, however, be many times more, as throughout the year there will be a turnover of stocks by the growers and traders in foodstuffs.

Central assistance to commercial firms in setting up cold storages includes technical assistance and guidance about the type of refrigeration units suitable to a particular area, the best method of working the plants and help in making available equipment and machinery required for the industry. Private enterprise has so far invested about five crores of rupees in the industry for building about 100 cold storages by 1950, of which 50 are already in operation.

In view of the importance of potatoes in augmenting the food supply, special preference has been given to the storage of seed potatoes in these units. Some of the units are also utilized for the storing of fish, while there are a few of a multi-purpose nature, located in big consuming areas or at ports like Calcutta, Madras, Bombay.

The largest number of cold storages is located in the important potato belt of the Gangetic plain. The United Provinces alone propose to build 43 units. Plants are also proposed to be set up in Delhi, East Punjab, Central Provinces, West Bengal, Bombay, Mardas, Ajmer-Merwara and Saurashtra.—*P.I.B.*

SCOPE FOR THE MECHANIZATION OF AGRICULTURAL PLOUGHING IN INDIA

CONDITIONS of agriculture in India are very different from those in America or Western countries. The tropical sun; the teeming population; the tiny holdings of the average cultivator; the concentration of rains in a small period of the year with its practical absence in the rest of the period; the relative hardness of the soil; the long period the lands have been under cultivation without sufficient manure necessary for their recoupment; and the absence of machine-mindedness on the part of the agricultural population,—all these factors present problems different from those of Western industrial countries. Any power-operated machinery that is introduced into this country has, therefore, to take into account the peculiar conditions above referred to and the machinery has to be specially designed to suit those conditions.

Practically all the food crops in use in this country are of three to five months growth and require water to mature. Except in irrigated lands which form but a fraction of the total area under cultivation, the crops have to be grown and matured only in the rainy season when the land will be soft enough for tilling and the ground will have retained sufficient moisture to bring the crops to maturity.

The rainy season in most parts of the country lasts only for three to four months but over large areas, the rain waters are collected in ponds or tanks capable of holding water for three or four months longer and irrigating the lands below them for this extended period. It is thus essential that the whole cultivation, from tilling the soil to the maturing of crops, should be completed within the short rainy season or before the tanks get dry.

To accomplish this, it is necessary that all lands should be tilled and seeds sown within a week or ten days after the first monsoon rains, so that before the end of the rainy season the crops will reach maturity. This need is well understood throughout India. It will be seen in every agricultural village that as soon as there is a heavy shower of rain, every ryot is on his field ploughing the land. It is in order to have this simultaneous ploughing that every agriculturist maintains a sufficient number of plough cattle so that he can have his lands ploughed and seeds sown within a week or 10 days after the first rains.

Any machine that is brought to this country should therefore satisfy this fundamental condition. Secondly, there will be no road or trackway to the fields and the plough should be light enough or the heavy parts readily detachable so as to be capable of being carried by a few men to the field and assembled in a few minutes for use. Thirdly, the cost should be such that a small cultivator having about 15 to 20 acres or a small group of cultivators of like area can afford to get a mechanical plough and till the whole of their 15 to 20 acres within a period of about 10 days.

The plough to be brought into extensive use in India should, therefore, satisfy the following requirements:

(1) It should be light or have heavy parts detachable so as to be capable of being carried to the field by three or four men and there assembled in a few minutes.

(2) It should be of low cost so that the small agriculturist owning 15 to 20 acres can own one. The aim should be to make the machine available to the agriculturist at a cost not exceeding Rs. 1,000 each.

(3) It should be of a capacity to till about $1\frac{1}{2}$ to 2 acres in a day of say 8 to 10 hours working.

(4) The owner-cultivator should be able to operate it.

(5) The machine should not be complicated but easy to manipulate and should have all

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Home Gleanings

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The rainy season in most parts of the country lasts only for three to four months but over large areas, the rain waters are collected in ponds or tanks capable of holding water for three or four months longer and irrigating the lands below them for this extended period. It is thus essential that the whole cultivation, from tilling the soil to the maturing of crops, should be completed within the short rainy season or before the tanks get dry.

To accomplish this, it is necessary that all lands should be tilled and seeds sown within a week or ten days after the first monsoon rains, so that before the end of the rainy season the crops will reach maturity. This need is well understood throughout India. It will be seen in every agricultural village that as soon as there is a heavy shower of rain, every ryot is on his field ploughing the land. It is in order to have this simultaneous ploughing that every agriculturist maintains a sufficient number of plough cattle so that he can have his lands ploughed and seeds sown within a week or 10 days after the first rains.

Any machine that is brought to this country should therefore satisfy this fundamental condition. Secondly, there will be no road or trackway to the fields and the plough should be light enough or the heavy parts readily detachable so as to be capable of being carried by a few men to the field and assembled in a few minutes for use. Thirdly, the cost should be such that a small cultivator having about 15 to 20 acres or a small group of cultivators of like area can afford to get a mechanical plough and till the whole of their 15 to 20 acres within a period of about 10 days.

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(4) The owner-cultivator should be able to operate it.

(5) The machine should not be complicated but easy to manipulate and should have all

spare parts readily available.

(6) The power unit should be detachable or made available for use for other work such as pumping, cottage industries and garden cultivation, etc. when the plough is not in use.

(7) The frame and wheels may, if necessary, be of timber strengthened by steel plates so that the machines can be made cheaply and repairs can be effected by country carpenters and smiths.

If Indian engineers set to work to design a unit to satisfy the above conditions, it can easily be accomplished. Such a machine will soon become very popular and come into extensive use in a short time especially now when plough cattle are very costly and in short supply. An agriculturist cultivating 15 to 20 acres requires at present from four to five pairs of cattle which at present day costs cannot be got for less than about Rs. 750 even for low grade animals. The agriculturist will not therefore grudge to invest a little more in securing a reliable mechanical plough.

The better tillage and timely work got from the machine will enable him to get a greater yield from his lands and this will go a long way towards securing to the country self-sufficiency in food production. The agriculturist will be freed from the necessity to maintain a large herd of half-starved plough cattle of low vitality and, with the saving thus effected in his fodder resources, he will be able to maintain milch and drought cattle, feed them well and secure adequate milk supply to the people and, in course of time, even improve the cattle breed.

It is often erroneously thought in villages that these plough cattle are necessary for getting manure. This is a fallacy. We can secure the same manure and in addition get our essential milk supply by utilizing the fodder resources on milch and a better breed of drought cattle.

The manufacture of the simple plough above described in this country will be quite easy. For some time, possibly, a light power unit of six to eight H.P. say of the J.A.P. or other light type engine and a worm type reduction gear may have to be imported but the other parts can easily be manufactured in this country in any fair sized workshop.

The Government can help a good deal by getting power units and reduction gear of a standard size on a large scale and supplying them to workshops at actual cost for building the ploughs, charging a fair price for the machines. If serious attempts are made it should be quite possible to produce the ploughs in about six months time and at the cost above suggested.

Where electricity is available in villages, as in some parts of Madras, agriculturists have already taken to pumping from wells on a mass scale for cultivation. In these cases a plough, making use of the available electric motor and currents, would be very helpful but a suitable design would have to be evolved and the machine produced and made available to the agriculturist.

The educative value of such machinery to the agriculturist, the impetus the machines will give to the educated class to take to productive labour instead of looking to clerical work as their sole aim, and the secondary lucrative occupation which they will give to the agriculturist, will all raise the standard of living in the villages and tend to put a stop to the migration of villagers to towns and even promote a tendency in the opposite direction.

Alertness, regular working hours, discipline, aptitude for physical work and many more good habits which tend to increase production and make a nation great, are the accompanying factors when the mass of people become machine-minded. Nothing in this agricultural country will foster this as small machines of the type described distributed throughout the country.

Large tractors of the type now being imported are useful in country only when large areas of fallow lands are to be brought under cultivation and deep ploughing is required to root out weeds. They require large initial outlay, costly operators and, as working period will be short, they have to be kept idle for the great part of the year thereby adding to the overhead charges. Further, for raising good crops in lands already under cultivation, deep ploughing is unnecessary and may even do positive harm. Large-sized tractors intended for deep ploughing are not required for such lands and hence are not likely to become as popular as small machines.

Introduction of the small machinery as above described on a mass scale will also bring opportunities for subsidiary occupation on a large scale in the villages and thus raise the overall standard of living of the masses.—Reproduced from *Transport-Communications*, May, 1949.

Book Reviews

THE INDIAN SUGAR INDUSTRY (1947-48 ANNUAL)

Edited by M. P. Gandhi (Gandhi & Co., Jan Mansion, Sir Pherozeshah Mehta Road, Fort Bombay, pp. 136, Rs. 6).

THE Annual like its previous numbers is a comprehensive reference book on matters pertaining to the sugar industry of India. It contains a chapter devoted to the various statistics of the sugar industry, a chapter containing a review of the industry during 1947-48 and a chapter bringing to the forefront the main problems of the industry and suggestions for its future development. Shri Gandhi deserves credit for collecting all the statistics from their various sources of issue so expeditiously and for compiling them in the lucid manner in which they have been presented in the book.

The review of the sugar industry for 1947-48 has been made in the context of political and economic conditions prevailing in India during 1947-48 and the prospect of production for 1948-49 has been based on the trends of public and official thought manifesting itself a few weeks prior to the start of the crushing season 1948-49. The question of sugar and sugarcane prices has therefore received due attention and Shri Gandhi has expressed his own views rather boldly on the controversial points regarding 'High Profits to Factories in 1948' and 'Misapprehensions About High Sugar Prices Following Decontrol'. In the reference to the question of export of sugar from India to countries of the Middle East, Pakistan, Celyon and Burma, the desirability of establishing an export trade and the necessity for bringing down the level of sugar price to about Rs. 26 per maund for the purpose, has been rightly stressed.

The question of withdrawing or continuing the protection granted to the sugar industry in 1932, which is now under the consideration of the Tariff Board has been discussed at some length and it has been brought out that the present time being abnormal is inopportune for any inquiry into the question and that protection must be continued for another period of five years ending 31 March, 1954.

The chapter on 'Main Problems of the Industry' appropriately starts with the para entitled 'Agricultural Improvement Needed'. While discussing the agricultural aspect of cane growing, Shri Gandhi states 'From the above discussion it will be conceded that the improved varieties of cane with more vigorous growth and higher tonnage would naturally call for higher soil fertility, better cultivation and more solid moisture than the indigenous cane. The best use of the potentialities of these new varieties of cane can, therefore, be made only by the application to the soil of sufficient quantities of organic manures and artificial fertilizers of the correct type ensuring thereby adequate supplies of nutrients to the growing plant. The higher metabolism of the plant also requires more frequent and larger quantities of irrigation water. These two essential factors in successful cultivation of sugarcane and the value of better tillage and suitable rotations along with the desirability or otherwise of taking one or more ratoon crops in the same field, have not unfortunately received the attention which is due, at the hands of the average cultivator. The consequence has been that the spectacular yields secured originally from the more improved varieties cannot be maintained from year to year, and a rapid decline in growth and yield consequently follows!' Indeed the above is the crux of the whole problem. The chapter includes a few pages on 'World Sugar Production' which has added to the value of the book.

It is satisfactory to note that on the whole due emphasis has been laid on the important problems of the industry such as need for reducing the high level of sugar and sugarcane prices prevailing during the year, the need for an all out drive for increasing the yield of sugar per acre by development and research on sugarcane, the need for continuing protection to the industry, the need for a common Central Sugar Sales Organization, the need for developing palm-sugar production, the necessity of improving *gur* production from sugarcane and last but not the least the need for intensification

of Agricultural and Technological Research under the auspices of the Indian Central Sugarcane Committee by restoring to it the research grant recommended by the Tariff Board and agreed to by the Government of India in 1947. (S.C.R.)

FARM ACCOUNTS

By E. Sewell Bray and C. V. Dawe (Oxford University Press, London, 1948, pp. 103, 15s. net).

THE book is divided into four chapters. The first chapter deals with Farm Accounts. The Farm Account Book devised by the Department of Agricultural Economics, University of Bristol, has been recommended and the various forms for keeping records have been set out in detail in Appendix I. The accounts dealt with in this chapter are mainly kept for the assessment of income tax and enable one to determine the general financial position for the year. They do not permit the calculation of the cost of production of various farm products. For this purpose cost accounts are needed. These are discussed in the second chapter. Under this system the bulk costs are allocated in a systematic manner over the various branches of the farm where these were incurred. The various forms required for this purpose and the method of filling them have been detailed. The third chapter is a discussion of the purposes to which financial and cost account data can be put for economic purposes, such as the study of markets and marketing processes, land economics and utilization, agricultural labour and wages, prices and price variation. Besides this, accounts are of great value in dealing with the day to day problems of farm management with the help and guidance of an economist. The fourth chapter deals with the relationship of professional accountant with the farmer.

In view of the introduction of controls on the various agricultural products, the move to charge the land revenue on income-tax basis, the agitation for the equitable distribution of produce between the tenant and the landlord and for determination of compensation for abolishing zamindari, it is very essential that reliable and accurate farm account be kept. Unfortunately much work in this line has not been done in India. The book under review will, therefore, provide the farmer, the economist and the administrator all the guidance they require in preparing clear and simple accounts of all operations. (K.S.).

THE INDIAN COTTON TEXTILE INDUSTRY (1947-48 ANNUAL)

Edited by M. P. Gandhi (Gandhi & Co., Jan Mansion, Sir Pherozeshah Mehta Road, Fort, Bombay, Rs. 6).

THE developments connected with the various aspects of the Indian Cotton Textile Industry during 1947-48 have been comprehensively dealt with in this Annual. Several constructive suggestions have been made while discussing the present position and future prospects of the industry. The necessity of a larger expenditure on research and extension work for improving the quality and increasing the quantity of raw cotton production in India, particularly in the light of the effects of the partition of the country, has been stressed in the Appendix relating to raw cotton. This is an issue which cannot be emphasized too often in view of its importance to the national economy of the country.

Besides useful statistical data which are presented separately to give an idea of the industry at a glance, the Annual contains the texts of important control orders and up-to-date lists of cotton mills in India and Pakistan. The usual Appendix on the handloom weaving industry has been revised and enlarged. (K.S.).

News and Views

FIGHTING THE FODDER FAMINE IN GUJERAT

WITH the onset of the monsoon in Gujerat came the end of what was undoubtedly an unprecedented fodder famine which affected Cutch and Saurashtra, as a result of the failure of the monsoon last year. Famine conditions prevailed over 220,000 square miles, an area twice as large as undivided Bengal and having a cattle population of 5,70,000. And yet because of the timely assistance rendered, and the willing cooperation between the official and non-official agencies and between the various Governments, there was no loss of human life and only a small number of cattle were lost.

The conquest of famine in Cutch and Saurashtra represents not only a triumph of non-official and official efforts, but also an alert organization and careful planning. Gujerat is a cattle-breeding area famous for its Gir and Kankraj breeds of cows and the Surti, Mehsana and Jaffari buffaloes. Had the full resources of the Government not been mobilized in time, a disaster of the greatest magnitude would have affected Western India.

During January reports came in of Cutch being in the grip of an acute fodder famine. Thousands of lean, unfed, neglected and abandoned cattle of well-known breeds like Tharparkar, Red Sindhi and Kankraj roamed in the interior. No fodder was available, and even the trees had been stripped bare of their leaves. Their very barks had been torn off to feed the cattle, many of whom lay dying or dead. The problem brooked no delay, and Sardar Datar Singh, Additional Secretary, Ministry of Agriculture, Government of India, was put in charge of the relief operations. He visited Bhuj and put into effect measures for immediate relief. Officials and non-officials, the Famine Commissioner and members of the Cutch Famine Relief Committee and of the local *pinjrapoles*, united in one common endeavour to save the cattle. Ten thousand tons of hay were immediately purchased from the Central Provinces and the procurement of fodder had begun in other areas. It was essential to move these stocks to Cutch without delay, and start the work of internal distribution. It was decided that abandoned cattle were to be collected in *pinjrapoles* which would also serve as distribution centres for fodder.

Relief plan

These measures were followed up in Delhi by a detailed relief plan and the Central Ministry of Agriculture made available the necessary personnel to put it into execution. It was agreed to move out of Cutch the unproductive cattle so as to relieve the pressure on fodder supplies and to make available concentrates to the *Rabaris* and *Bharvads*, the nomadic cattle breeders, at reasonable prices in the form of takavi loans against security. A Veterinary Officer with four assistants and first-aid equipment was sent to Bhuj to start relief operations immediately as no Veterinary Department existed in Cutch. Grants to local *pinjrapoles* in Cutch which had been discontinued, were revived, and in some cases increased, to encourage these institutions to collect and maintain the abandoned cattle. Remission of revenue on green fodder was allowed. Meanwhile, negotiations had been concluded for purchasing 3,90,000 maunds of grass from Madras and Bhopal making a total of seven lakh maunds secured within a few days.

Transport difficulties

Other difficulties had still to be overcome. The hay purchased was loose. The suppliers had neither baling presses nor baling wires. When these were secured, transport had to be arranged for their despatch to the places where they were required. The main problem was to

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Transport difficulties

Other difficulties had still to be overcome. The hay purchased was loose. The suppliers had neither baling presses nor baling wires. When these were secured, transport had to be arranged for their despatch to the places where they were required. The main problem was to

despatch the hay to Cutch quickly. It was possible to move it to Bombay, but sea transport had to be arranged to ports in Cutch. Shipping companies were reluctant to accept consignments of hay because of the risk of fire, and the freight by country craft was prohibitive. At this critical period an Indian steamship company offered three ships free of cost to move the fodder to Cutch. Such a spirit of cooperation is infectious, and the railway authorities made special arrangements for regular movements to Bombay so as to provide cargo for the steamers in time.

Supply of concentrates

Fodder had been secured in adequate quantities. There was now urgent need to supply concentrates at reasonable prices. The people were willing to buy them. If, therefore, sufficient quantities of concentrates could be made available, the quantity of fodder required could be substantially reduced. This would mean a considerable saving in Government expenditure as the distribution of fodder was being subsidized.

The surplus areas for groundnut cakes and cottonseeds are Bombay, Central Provinces and the Hyderabad State. The first two Provinces supplied each 2,000 tons of groundnut cake and Hyderabad offered an equal quantity of cottonseeds—all at controlled rates. Loans of concentrates free of interest were given to nomadic breeders against securities.

The scheme worked satisfactorily. Ample stocks of fodder and concentrates were available at nine main depots and 67 supply centres of distribution. In addition, 17 *gowshalas* and 81 centres were providing facilities for abandoned cattle. There was general satisfaction over the supply and distribution of cattle feeds. The nomadic breeders utilized to the full, the loan facilities given to them which resulted in a considerable improvement of the condition of their animals. The rate of cattle mortality registered a sharp decline and the production of *ghee* increased.

Famine in Saurashtra

Just when Cutch had turned the corner reports began to pour in of a fodder famine in Saurashtra. It was immediately decided to coordinate the procurement and movement of fodder both for Saurashtra and Cutch. This work was also entrusted to Sardar Datar Singh who had already taken a leading part in fighting the fodder famine in Cutch.

All fodder which had been secured for either Saurashtra or Cutch was pooled, and a decision was reached in consultation with the Governments concerned, about the distribution of the supplies between the two affected areas. The position of hay stocks indicated that a total quantity of about 75,000 bales would be available during the months of May and June. But it was no longer possible to move all the fodder by the combined rail and sea route. It was arranged to send as large quantities as possible by rail, and the balance was to be moved by the combined rail and sea route.

Fodder movement

During a single week 10 special trains left Madhyabharat for Navalakhi carrying about 6,000 bales of hay. In addition, fodder also moved in a large number of wagons from other areas in Madhyabharat. During the same period a steamship load of fodder reached Bhavnagar from Bombay. To resolve the congestion of traffic, which resulted from the rapid movements of fodder from a number of centres, a dump was created at Viramgam for stocking consignments which could not be transported immediately. During this period fresh stocks of about 90,000 maunds of hay were located, and the Saurashtra Government was advised to procure it. To ensure that the steamers at Bombay carried full cargo loads, ready stocks from all stations in the supplying areas were rushed to Bombay by special trains as far as possible, and three steamers were able to carry about 23,000 bales to Bhavnagar in a week's time. In addition, special trains transported about 55,000 maunds of weeviled gram and gram *chuni* to meet the requirements of concentrates. During this period 2,300 tons of *jowar* seeds were also moved to Saurashtra in order to be utilized for sowing fodder crops during the current season. Within a short period the entire stocks from Madhyabharat and Jhansi Division had been cleared. The transport of stocks from other areas was also on schedule and two more steamers with about 30,000 bales had left Bombay for Bhavnagar. Some congestion was also reported at Navlakhi, but with the cooperation of the Saurashtra Government, the

FIG. 1. Abandoned cattle collected in *pinjrapoles* for relief during the fodder famine

FIG. 3. Thari bull belonging to His Highness the Maharaja of Cutch kept at Mandvi. The bull is active and in service

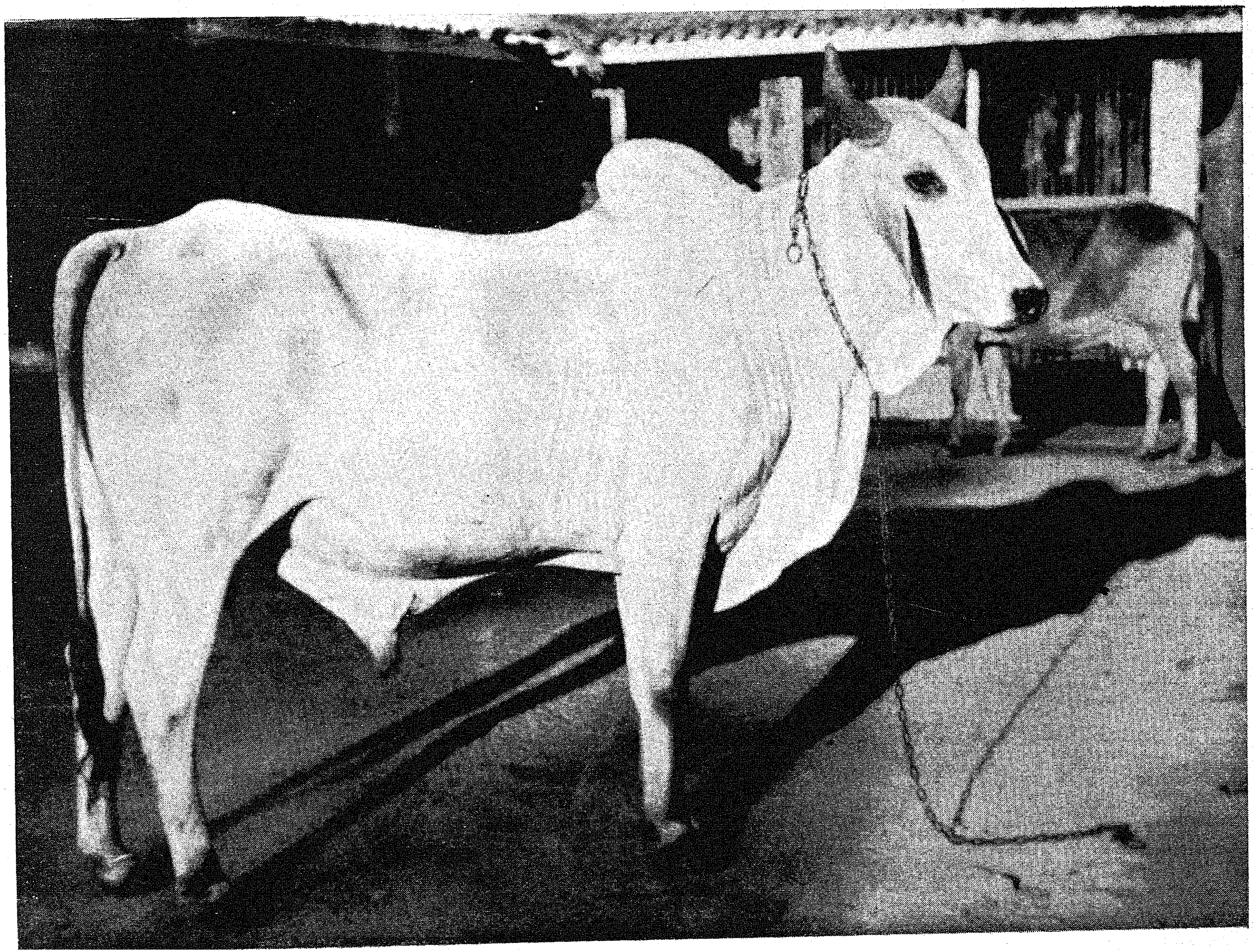

PLATE 6

PLATE 65

FIG. 2. Loading of bales of hay from Forest Department Grass Depot for transportation to the Railway Station, Indore

services of two tugs, 15 barges and two propellers were secured and the accumulated stock was cleared within a few days.

The 'out of danger' signal has now been hoisted in the two areas, as sufficient stocks have been moved to last until the onset of the rains. A noteworthy feature of the famine relief operations is not only the saving of cattle lives but also a considerable saving in expenditure. Against a total estimated expenditure of Rs. 108 lakhs sanctioned by the Government for fighting the famine in Cutch, the operations were completed at a remarkably low cost of approximately Rs. 30 lakhs which has been possible only because of the well-planned and coordinated efforts of officials and non-officials, who fought back a famine of unprecedented proportions. (*P.I.B.*).

IMPROVEMENT IN COTTON MARKETING

THE Cotton Marketing Committee appointed by the Ministry of Agriculture to suggest ways and means of improving the marketing of cotton has addressed Provincial and State Governments and some organizations dealing with cotton for their views on the improvement of cotton marketing in the country. Institutions and individuals interested in the subject who wish to offer their views, are advised to send their opinions to the Secretary, Cotton Marketing Committee, Directorate of Marketing and Inspection, 'P' Block, New Delhi, so as to reach him by September 15, 1949. (*P.I.B.*)

* * *

THE 11th ALL-INDIA BEE-KEEPERS' CONFERENCE AND BEE EXHIBITION

The 11th All-India Bee-Keepers' Conference and Bee Exhibition will be held on the 2nd, 3rd and 4th December, 1949. Arrangements are being made to hold Agri—Horti—Industrial exhibition along with the same. Persons requiring any information are requested to write to the Secretary, Reception Committee, 11th All-India Bee-Keepers' Conference and Bee Exhibition, Gandhigram, Nandgad District, Belgaum.

PAPAIN

By M. B. R. SINGH

A PRODUCT which has a great future before it is papain, contained in the latex of the milky juice of the papaw (*Carica papaya*) tree. Papain is an active enzyme akin to pepsin. Its uses are mainly medicinal though it is put to several industrial uses as well. In medicine papain is used for combating dyspepsia and other digestive disorders. It is also employed in cures for diphtheria, cancer, and as a vermifuge. It was used as a valuable cholera bacteriophage during the cholera epidemic in South India in 1943-44. In France it is mixed with starch to preserve it and is often made up in the form of papain lozenges 'Syrup de Papain'. Papain wine and papain elixir are also favourite forms. It is used in the treatment of bleeding piles, ulcers, ringworm, enlargement of the spleen and tapeworm. It is also used in criminal abortion. The bruised leaves applied as a poultice have an excellent influence in reducing elephantoid growth. It is used in the preparation of chewing gum in the U.S.A. and in preparations for tenderizing meat. A solution of papain can be used as a substitute for curdling milk. Due to its capacity for digesting protein it is used in the brewing industry in a process for making 'chill-proof' beer. It has also been found useful in tanning leather. Recently papain has been used for degumming natural silk when it is mixed with rayon or wool in fabric weaving. It has also found application in the woollen industry. Wool treated with papain is found to take on a silk-like sheen and its tendency to tickle the skin and shrinkage is eliminated. It is stated that this anti-shrinkage treatment gives the woollen garment a greater range of usefulness than hitherto and permits their being washed in the same way as cotton garments. In Australia it was claimed that nearly 5,00,000 pairs of socks could be treated every week by the above process at the cost of one penny per pair. Papaw juice is also used for softening *tasar* cocoon and thus facilitating their being reeled. At present Ceylon and Tanganyika are the only countries producing papain on a commercial scale. Although possibilities of its production in India exist not much progress has so far been made. Before the war Japan exported some quantity mainly produced in one of the Caroline Islands in the Pacific. Till 1944 Ceylon was the chief exporting country but for the last few years the first place has been taken by Tanganyika. The increase in demand in papain is attributed to the world shortage of pepsin which is not likely to be overcome for some time. There are two grades of papain, viz. (1) sun dried and (2) oven dried. The latter is of a better colour, greater enzymatic activity and realizes better prices. Before the war the average price in London of Ceylon papain of good digestive value was only eight shillings per lb. The oven-dried papain usually commanding a premium of 3d. to 6d. per lb. over the sun dried. The chief importer of papain is the U.S.A. In 1938 the U.S.A. imported 2,23,000 lb. of crude papain valued at Rs.3,29,000 as against 1,80,000 lb. valued at Rs. 2,65,000 in 1937 and 54,000 lb. valued at Rs. 50,000 in 1932.

DIPLOMA IN FRUIT PRESERVATION AND CANNING

The following candidates have been declared successful in the Diploma Examination in Fruit Preservation and Canning held in August 1949, under the auspices of the Indian Council of Agricultural Research :

First Division

Miss P. Parvathi (Madras); Miss C. K. Rajam (Madras); Miss Nirmal Bhasin (Delhi) and Mrs. Kamini Kaul (Himachal Pradesh).

Second Division

Miss G. K. Guanambal (Madras); Miss Satwant Kaur (East Punjab) and Miss Swaran Pasticha (Delhi).

CERTIFICATE IN AGRICULTURAL STATISTICS

The following students have passd the examination of the post-graduate Certificate Course in Agricultural Statistics of the Indian Council of Agricultural Research, held in August, 1949 :

First Division

Mr. S. R. Sharma.

Second Division

Messrs. M. A. Telang, D. R. Kohli, P. N. Mathur, G. K. Mathur, A. S. V. Gopalan, B. D. Tikkiwal, S. S. Chinney and B. M. Kumbhare.—(*P.I.B.*)

ERRATA

Indian Farming, Vol. X, No. 6, June 1949, page 245, Table III :

Under D-4 (No. 1) Caterpillar Tractor, Period 2nd, last item (Depreciation), for 8701 *read* 870.

Under D-4 (No. 2) Caterpillar Tractor, Period 1st, last item (Depreciation), for 910 *read* 1910.

Under Farmall Row Crop Tractor, Period 1st, 5th item (Lubricating oils), for 30 *read* 130.

Under W.D. 40 McCormick Deering, Period 2nd, 6th item (Repair and servicing) for 178 *read* 187.

COVER ILLUSTRATION

H. E. Shri C. Rajagopalachari, Governor-General of India, along with others inspecting the maize harvest in the Estate.

INDIAN FARMING

NOVEMBER, 1949

Vol. X No. 11

DEVELOPMENT OF BONE-MEAL INDUSTRY*

WE are meeting after more than one year. I think some of you were present at a Conference which was called some time about the middle of last year—I think in the month of May. But this time we have troubled you really for the consideration of more fundamental problems relating to the bone industry.

I feel that the time is opportune for placing our bone industry on a stable foundation if we plan properly at this time. As you know, our food production programme with its time-limit and other compelling circumstances will necessitate more and more attention being paid to the development of local resources for manures and fertilizers. Even independently of this immediate programme, the bigger schemes for both food production and agricultural development will necessitate larger and larger use of fertilizers and manures, and, obviously, bone in India is a big source for manufacturing our own fertilizers. In the course of discussion of the agenda I would wish you to have that larger objective before you, so that as a result of these discussions we might be able to reach decisions which would have considerable effect on the industry.

While discussing the items on the agenda and pressing the individual points of view of each interest, I would request you to try to reconcile the conflicting opinions, attitudes and lines of action of the different interests. Unless such reconcilation is arrived at, we will not be able to make due progress. It is only when each interest tries also to look at a problem from the point of view of the opposite interest that the ultimate decision goes through with maximum cooperation. I would, therefore, wish you to have that attitude in dealing with the problem before you.

Now, one of the items which has to be considered by you is how to increase the raw materials of the industry, that is, what steps should be taken to see that we get the largest quantity of raw bone. Then the other matter that you have to see to is, having secured the largest quantity of raw materials, how we can utilize it. At present there are certain factors which compel the industry to export crushed bones, leaving here in the country bone-meal for use by the agriculturists. But this, as you will all agree, is a temporary phase. In most countries of the world, the bone industry has reached a stage when the entire raw material is utilized by producing other articles from it. I would, therefore, request those who take part in the discussion today to throw some light on that aspect of the question—that is, what exactly is the stage that the industry in India has reached for utilizing the entire raw material.

I propose at this Conference to follow the procedure of having a general discussion for some time and then set up committees to deal with some of the items. Then the reports of those committees may be considered on Wednesday, if you will be here till then. Otherwise, we will have to have a late evening sitting to consider the reports of these committees. I want the full utilization of the raw materials to be considered by a committee on which the various interests may be represented.

Then there is this question of the by-product bone-meal which we want for agricultural operations. Possibly most of you feel that this is probably the most important item to be dealt with—that is, the fixation of the price of bone-meal. There are various standpoints from which a

* Inaugural address delivered by the Hon'ble Shri Jairamdas Daulatram on 23 August, 1949, at a Conference in New Delhi convened by the Central Ministry of Agriculture for the development of bone-meal industry.

decision with regard to the price of bone-meal could be considered. But I would like you, if you have the active interest, the larger and abiding interest of the industry at heart, to take one fact into consideration. After all, whatever might be the price which you may work out for the bone-meal on the basis of the price of crushed bone, as well as the cost of manufacture, the bone-meal is required by the agriculturists and if the agriculturist finds that the price which he has to pay for the bone-meal is not low enough for him and it has no relationship to the value of the extra produce which he receives as a result of the use of bone-meal, he is not likely to take to it. So far as Government is concerned, we want to utilize our fertilizer and manure resources to the maximum extent possible for our urgent needs and one of the most urgent needs is food production. We have also got programmes for the development of the cultivation of jute and cotton. But relatively food production is the most important of our programmes. Therefore, in fixing the price of bone-meal, the over-riding consideration that ultimately will sustain the industry, or ultimately make it possible for the agriculturists to continue to be the purchasers, consumers and customers of this product is that its price must be related to the return which the agriculturist gets. Last time we had fixed the price of bone-meal at Rs. 170 per ton. So far as I can recall, no very detailed examination of any data or material was made by us in fixing this price. We were given certain figures with regard to the price of crushed bone, as well as the cost of production, on the basis of which we fixed the price. Now we have to deal with this matter in a more detailed manner. If we want to make bone-meal a popular fertilizer, then, as I said, you must see that the price has a bearing on the return of the agriculturists. If all the data is available with you here, then it may be possible, sitting for a number of hours, to go through them. Otherwise, we will have to collect the information from sample factories, with the cooperation of the manufacturers. I find, from the views expressed by some of your representatives, that it is your desire to fix a figure as high as Rs. 200 to Rs. 220. But, as I said, this is a matter which has to be examined in some detail.

It is a fact that the raw material of the bone industry is mostly available far into the interior of the country, I mean the rural areas, while factories are concentrated in a few urban areas. The same is the case with regard to certain other industries as well. Take for instance the sugar industry. Most of the sugar factories have got concentrated in two provinces whereas the consumers are scattered all over the country. It has been suggested with regard to the bone industry that since the raw material is scattered throughout the country and the consumers are also scattered throughout the country, decentralization of the industry will lead to greater efficiency. These decentralized factories may be individual factories or cooperative factories. All these are matters of detail which have to be worked out.

At present we find that we are very much in the dark with regard to our statistical position. We do not know what is the total quantity of raw bones of various kinds available in the country. Nor do we know how much ultimately goes waste or is absorbed by the soil. We also do not know as to what is the exact quantity which can be utilized by the industry. A great deal of other detail is necessary and I hope your organization will assist us in getting correct statistics.

We shall also be glad to hear from you what assistance you require from Government in the matter of expanding the bone industry.

The present practice is to export our crushed bones and to import rock phosphates. I do not know how far it is possible always to correlate the two things. But I feel that whatever may be the programme at present of importing rock phosphates it may be wiser ultimately that our fertilizer industry must be based on internal raw materials. We know our industrial development is often based on raw material which has got to be imported. But then many difficulties can arise which may prevent us from getting our raw materials. Wars occur and other complications can also come about. Though the bone industry is developing on the basis of rock phosphates, I think it is wise to plan for the development of the industry on internal resources. This should be considered and investigated though I realize no decision can be taken at this Conference.

Original Articles

TREAT YOUR CEREAL SEEDS AND CONTROL MANY SERIOUS DISEASES

By H. S. PRUTHI

WHEN a farmer plants his seed of cereal and other crops, the stands of seedlings and later health of adult plants that he obtains may not as a rule be good. If the crop is to be transplanted, the seed rate in such cases has to be high because there is a great deal of pre-emergence rot of the seed and of seedlings due to 'damping off' or 'seedling blight'. That is because the seed of some of the cereal crops carry with them spores of parasitic fungi or such spores may lie in the soil and attack the kernels and the young seedlings as they emerge out of the seed and come out of the soil. If the conditions of environment are favourable for disease development then such mortality is very high. As a general rule, however, even when the conditions are not optimum, some seed and seedlings succumb to the injuries which these fungi and sometimes even parasitic bacteria cause to them. Losses due to such 'pre-emergence rot', 'damping off', 'seedling blight', 'foot-rot', etc. are sometimes very appreciable necessitating replanting or excessive seed rate. Foot-rot for example may cause considerable damage to the wheat crop in many parts of India, especially Central Provinces and Rajputana. The seed rate has therefore to be high as much as 130 lb. per acre instead of a normal rate of 60 to 70 lb. Foot-rot of rice occurs in Madras, Bengal, Assam and other places and effects the crop in all stages of growth but is mostly destructive in the seedling stage. Another important disease of rice is seedling blight which commonly occurs in Bengal, Orissa and Madras. Seedling blight causes considerable losses in India.

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Certain smut diseases such as grain and loose smuts of *jowar*, covered smut of barley, flag smut of wheat, covered and loose smuts of oats cause considerable damage to the yield and quality of the grains. Leaf spot of wheat which normally occurs in the Punjab is also now reported to occur extensively in certain wheat growing areas of the south. Damage due to the disease has been appreciable in certain years and in South India it has been recently observed in a serious form. Stripe disease of barley is also a common disease which may cause either pre-emergence rot or seedling blight. Under favourable weather conditions, the course of the disease is usually progressive until finally the ears are infected when they fail to develop normally and a condition of partial or complete blindness results.

Seed treatment

It is the object of this article to explain that the diseases described above which are externally seed borne or sometimes also soil-borne, can be successfully controlled by seed treatment. Diseases caused by air-borne spores such as rusts, mildews, head blights or the internally seed borne diseases such as loose smut of wheat and barley cannot be controlled by seed treatment.

Treating the seeds with dusts which have fungicidal and bactericidal qualities provides an effective barrier against the growth and entry of the organisms into the seed. Some fungicides give additional protection by diffusing into the soil around the seed and retarding the growth of parasitic fungi that may be present in the soil.

The ultimate aim of seed dressing, therefore, is to secure good stands of healthy plants and therefore good yields from the crop. The

fact that good stands and yields are often obtained without seed treatment should not lessen its importance because seed treatment is a prophylactic measure which is practised irrespective of whether the disease in a season is or is not present. If the seed has not been treated and the disease appears in an epidemic form, it would be too late to put into effect this practical method for preventing such diseases. Seed treatment, therefore, is an insurance against loss of crops.

Dressing the seed with fungicidal dusts will, therefore, prove to be beneficial in several ways.

1. Fungicidal seed dressings destroy the externally seed-borne fungi causing plant diseases, thus increasing yields and quality of the crop.
2. They combat harmful soil inhabiting fungi that rot the seed and destroy the seedlings.
3. They help in establishing good vigorous stands which enable the crop to compete successfully with weeds.

The fact that seed looks clean or that it was the produce of an apparently disease-free crop grown from treated seed is no guarantee that it is disease-free and therefore not in need of treatment. Spores of several parasitic fungi carried beneath the hulls of oats, barley and rice and in the crease of wheat kernels are not easily observable. Even seed from a disease-free field may become contaminated by spores carried out by the wind or by the threshing machines from neighbouring fields. It is a good practice, therefore, to treat seed every year to ensure freedom from disease.

Different kinds of seed treatment

There are two ways in which seed can be treated, namely, wet treatment using dilute solutions of the fungicides or the dry treatment. For the wet treatments the fungicides must, of course, be soluble in water and those that are usually used are copper sulphate, formalin or some kind of water soluble organic mercury compounds. For dry treatment, the fungicides used are basic copper carbonate, different kinds of copper oxides and organic mercury or sulphur compounds which are sold in a ready made form properly diluted by commercial concerns. Recently, some organic mercury compounds have been suspended or dissolved in liquids of the consistency of the pure glycerine or heavy syrup which are used directly for treating the seed, like the dusts themselves.

Wet treatments: (a) Copper sulphate (2½ lb. of copper sulphate dissolved in 10 gallons of water) is a good fungicide for the control of smuts of *jowar* but it has the drawback of impairing germination of seed which in some circumstances may be appreciable; moreover, if not carefully carried out abnormal seedlings may be produced. It is not a suitable fungicide for oats, barley or rice as the vitality of these grains is injured by such treatment.

(b) Formalin: (1 pint of formalin in 40 gallons of water) is comparatively a more suitable fungicide and gives excellent control of not only oat smuts but covered smut of barley and loose and covered smuts of *jowar* as well; but in the case of the latter crop as the seeds are not covered by hulls the germination may get somewhat impaired. Moreover, it does not give a satisfactory control of diseases of wheat, barley, rice and oats due to Helminthosporium.

Dry treatments: The wet treatments have several disadvantages, the chief among which is the moisture of the treated seed which, if not quickly dried, may impair its germination. Moreover, seed treated by the wet methods cannot be stored for long periods but have to be used immediately and such treatments do not act as protectives. To overcome these drawbacks, dry fungicidal dusts have been developed which give excellent results. It may be stated that the success of dry dusts is intimately related to the fineness of the dust. If the dust is not extremely fine, that is of the order of passing through a sieve with 300 meshes per linear inch, its effectiveness may not be very satisfactory.

(a) Copper carbonate and oxide dusts: One of the materials, first used as a dust, was a finely divided basic copper carbonate powder. This dust (three to four ounces per maund* of seed) gives a fair control of *jowar* smuts provided that the grain is not badly contaminated. Other dusts are Yellow Cuprocide, red oxide of copper, etc. which are also used in more or less the same proportion. However, these

* One maund = 82½ lb.

dusts besides controlling smuts, do not control other seed-borne diseases as satisfactorily.

(b) Sulphur dust: Sulphur dust of extreme fineness, that is capable of passing through a sieve which is 300 meshes per linear inch, is very popular in India on account of ease of application, safety and cheapness of sulphur. It has been successfully used against grain and loose smuts of *jowar* and covered smut of barley. Three or four ounces of the dust to a maund of the seed grain are quite satisfactory.

(c) Organic mercury compounds: These materials have been found to be very useful, for they give good control not only of smuts but of numerous other diseases and prevent especially the pre-emergence rot of several crops. The proprietary organic mercurial seed-disinfectants vary in composition according to the particular commercial product. Their main ingredients are usually the effective organic mercury compound which may be ethyl mercury phosphate, ethyl mercury chloride, ethyl mercury acetate or other similar compounds. Usually the effective ingredient is one to three per cent, the rest being an inert diluent which serves as a carrier. Chief among such dusts are Agrosan GN, Semesan and New Improved Ceresan.

Non-metallic organic compounds: Several organic compounds without mercury in them have recently come into use as seed disinfectants. They are Spergon (Tetra-chloro-p-benzoquinone), Thiosan and Arasan (Tetra-methylthiuram-disulphide). They also give effective control of seed-borne diseases and for certain vegetable crop seeds Spergon has been declared to be very effective even though a bit more expensive than the other dusts.

It may be mentioned that organic mercury dusts are probably the best all-round seed fungicides. They are not only effective in controlling certain diseases but they also provide protection to the seed and thus improve germination and crop stands.

New liquid treatments: Among the new liquid treatments which are used in the same manner as dust is Panogen which is a Swedish product. It contains an alkyl mercury compound as its active ingredient and controls all parasitic fungi. Panogen is applied to the seed in the same manner as an ordinary dry seed dressing. The dose is 100 c.c. for 110 pounds of seed or roughly 1 c.c. for one pound of seed.

How to treat seed

Small quantities of seed may be treated by placing the required quantity of the dust in a bottle and shaking vigorously for two or three minutes.

An earthen pot with a lid may be used when a few seers of seed have to be treated. The grain and the required quantity of dust are placed inside the pot which is well-shaken for a couple of minutes after covering the mouth with the lid. Care must be taken to see that the pot is not more than half full.

For larger quantities a seed treating drum is very convenient and useful. Such a machine may either be got made locally or purchased ready-made through a manufacturer. It consists of an ordinary oil drum to which is welded an iron pipe. The pipe rests on the two sides on wooden or iron pivots so that the drum can rotate (Fig. 1). The method of treatment is a simple one. The grain is placed in the drum, the required dose of the fungicide added and the drum is revolved for three to four minutes. In this way each grain is coated with a very fine deposit of the fungicide.

Dosage: The quantity of the fungicide to be used varies somewhat with the crop, the disease and the fungicide used. The usual dose is 1 part of the disinfectant to 450 or 500 parts of seed. This comes to 5 to 7 tolas of the dust to 1 maund of seed.

Precautions: Certain elementary precautions must be taken when using the poisonous materials. It is advisable to avoid inhaling the dust. The nose and the mouth should therefore be protected with a cloth or a respirator. The fungicide should not be handled with wet or moist hands, and should not be allowed to come into contact with wounds or broken skin. After the treatment is over, any dressing on the hands should be removed by rinsing thoroughly.

The bags which have contained treated seed should be kept separately and washed before using them for carrying fodder, etc.

It is advisable that the mixing of the dust with the grain should be done in a reliable dust-proof machine. Grain should not be mixed with the powder on the barn floor or the mixing carried out in a sack.

Seed can be treated three to four months before sowing without impairing its germination. But the treated seed should be stored in a dry and ventilated place.

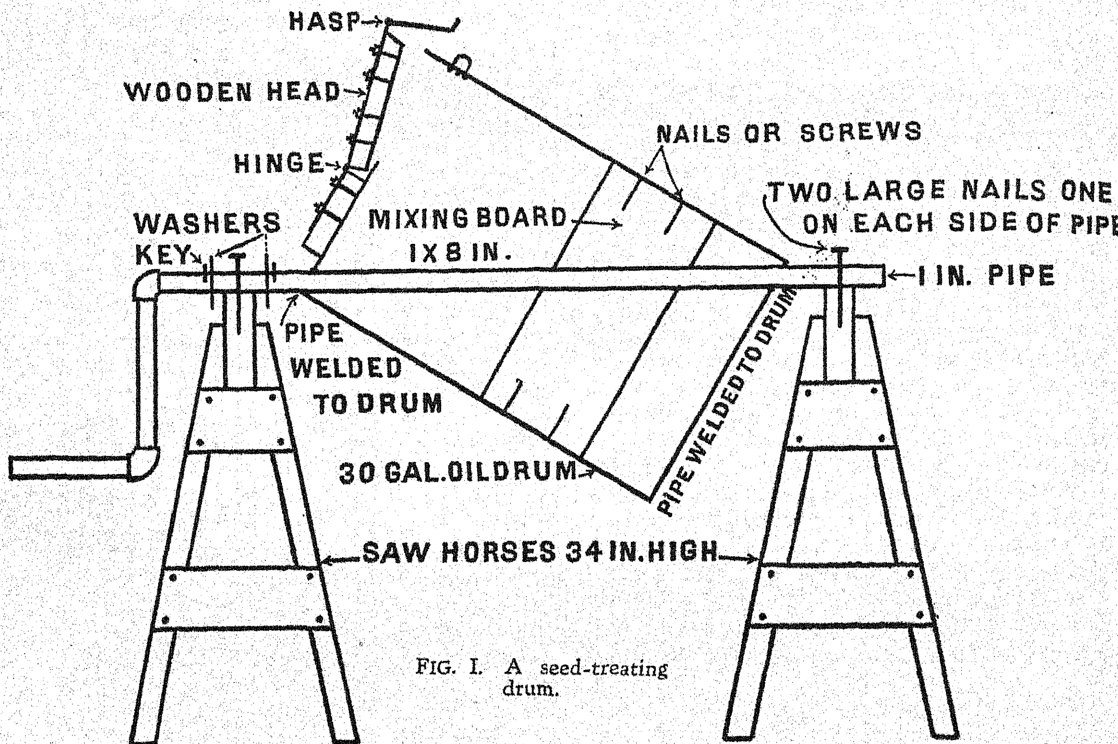

FIG. I. A seed-treating drum.

Cost of treatment

The cost of seed treatment varies with the cost of the material, the rate of application per maund and the seed rate per acre. On an average, the cost of treatment comes to about two to three annas per acre, being little more for wheat, barley and oats and much less for *jowar*, maize and rice. The cost of treatment of *jowar* seed comes to as low as one pice per acre. There is no doubt that the treatment will yield dividends several times over.

Hints for seed dressing

(i) Seed must be thoroughly dry at the time of treatment.

(ii) Do not fill more than half the seed-treating drum at a time.

(iii) Add the fungicide @ 1 in 450 to 500 parts, say five to seven tolas to a maund of seed.

(iv) Slowly rotate the drum for about 3 to 5 minutes (at least 100 rotations).

(v) Empty out the drum in such a way that the dust blows away from the operator.

(vi) Carefully label the treated seed.

(vii) The treated seed should be stored in a dry, well-ventilated place. If need be, the seed may be sown immediately after treatment. *In any case, do not store the treated seed in a closed room.*

(viii) The treated seed should never be used as food for human beings or as feed for live-stock. It should only be used as seed.

(ix) When the treating operations are over, the drum should be thoroughly washed with water so as to remove the sticking dust particles and later dried.

ROLE OF *GAUSHALAS* AND *PINJRAPOLES* IN THE CATTLE ECONOMY OF INDIA

By HARBANS SINGH

GAUSHALA literally means the home for cows. *Pinjrapole,* which means home for disabled animals, may also look after other kinds of animals besides the bovine.

These institutions are India's great heritage. During the last two centuries or so, due to economic and other factors, the slaughter of cows which was originally unknown to the people of India became a common practice. The trade in dead animals and their products became more flourishing than that of living animals and their products. The cow which was once considered the index of economic prosperity of the nation did not remain as such. In order, therefore, to arrest any further deterioration of the cow as a giver of milk and draught power and to give her necessary protection from indiscriminate slaughter and to house those infirm animals which have served throughout their lives, during their old age, the present day institutions of *gaushalas* and *pinjrapoles* were founded.

Number of gaushalas *and their distribution*

It is estimated that there are at present about three thousand *gaushalas* and *pinjrapoles* in India with a population of six lakh heads of cattle which are being maintained at a cost of about sixty million rupees per annum.

The following Table will show the estimated number of major *gaushalas* in various provinces and States:

TABLE I

Estimated number of major gaushalas *in provinces and States.*

S. No.	Province/State	Number of major *gaushalas*
1.	Ajmer-Merwara ...	7
2.	Assam	7
3.	Bhopal	10
4.	Bihar	100
5.	Bombay	90
6.	Central Provinces and Berar	60
7.	Cutch	23
8.	Delhi	7
9.	East Punjab	80
10.	Madras	50
11.	Orissa	20
12.	United Provinces ...	180
13.	West Bengal	25
14.	Hyderabad State... ...	15
15.	Kashmir and Jammu State ...	10
16.	Madhya Bharat Union ...	75
17.	Mysore State	20
18.	Patiala and East Punjab States Union	40
19.	Saurashtra Union ...	100
20.	United States of Vindya Pradesh	50
21.	United States of Rajasthan ...	200
22.	Other areas ...	200

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Potentialities

It is estimated that on an average twenty per cent of cattle maintained in these institutions could be classified as good dairy type. There are another twenty per cent which are fit for breeding and further grading while the remaining sixty per cent are old, infirm and unfit for further breeding. Thus, taking total population of these institutions at six lakhs, the number of cattle under different classes would work out as below:

S. No.	Class	Number	Percentage
1.	Good dairy type ...	1,20,000	20
2.	Fit for breeding ...	1,20,000	20
3.	Old, infirm and unfit for breeding ...	3,60,000	60
	Total ...	6,00,000	100

It was considered that by better management of animals in the first two categories

it was possible not only to substantially effect increase in the present output of milk from these institutions but also to convert them into centres for the breeding of improved bulls and bullocks. It was estimated that by proper handling an increased quantity of over one million maunds of milk per year could be produced from these institutions. At the same time they could provide twenty-five thousand males fit for use as stud bulls every year for replacement in the *gaushalas* and for distribution in the neighbouring areas for the improvement of ordinary village cattle. In addition to this, there will be about the same number of males available, after castration, for bullock work and fifty thousand improved female calves every year. These institutions could also serve the purpose of providing suitable centres for salvage of dry cattle from cities and towns. At present, due to lack of such facilities a large number of really fit milch animals which go to the big cities, find their way to the slaughter-houses after they go dry. Thus it will be seen that *gaushalas* and *pinjrapoles* do not only possess great potentialities as means of improvement of milk supply to the towns but can also serve effectively as centres for the preservation and betterment of the cattle wealth of the country.

Present conditions

Preliminary survey of these institutions has revealed the following main facts:

(1) *Gaushalas* and *pinjrapoles* are generally situated either in the heart of big towns or in their immediate neighbourhood where feeding and maintenance of cattle are unnecessarily costly.

(2) In most of these institutions the tendency is to overstock, with the result that the animals are generally underfed and are not properly looked after. This entails great hardship and suffering for the animals.

(3) There are no means of segregating the productive animals from those which are aged, infirm or otherwise economically useless. Thus, no discrimination is practicable in the feeding and management of good animals from that of unproductive ones, which makes good animals also worthless after a short time.

(4) Land attached to the *gaushalas* is generally insufficient for grazing of cattle or raising of fodder crops.

(5) Promiscuous breeding is practised as a general rule and no attention is paid to the selection of bulls for breeding which results in further increase in the number of inferior cattle.

(6) There are no proper facilities for veterinary aid or treatment of sick animals.

(7) Excepting a few *gaushalas*, which have their permanent funds managed by duly constituted trusts, the source of income of most of these institutions is from *Dharmada*, *Laga* or *Gaushala* Cess levied on the sale and purchase of principal commodities in different markets. There are some *gaushalas* which do not have the patronage of any business community and thus have to depend entirely on public charities and donations. Thus it will be seen that the income of these institutions is not only spasmodic and irregular but is also very uncertain which is a great handicap in envisaging permanent improvement in their management.

(8) These institutions are generally managed by untrained staff, and, therefore, there is no planned policy according to which the breeding and feeding of different types of animals and their management could be carried out.

Plan for their reorganization

It is, of course, not possible to suggest a common plan for the improvement of these institutions, situated under such widely different conditions. However, a general scheme for their reorganization is given below which may need slight modifications to suit local conditions. The plan essentially consists of the following four steps:

(1) *Segregation of different types of cattle*: In order to achieve results most economically and in the shortest possible time, the first step is to segregate the old, infirm and unproductive animals from the productive ones fit for breeding. Most of the *gaushalas* being located in or near towns, there is dearth of space leading to overcrowding and congestion. Moreover, high cost of feeding and labour in the cities makes the maintenance of productive type unnecessarily costly. It is, therefore, desirable that arrangements should be made to maintain these animals on grazings in the interior forests and other waste lands, without much cost, where they might even prove useful in fertilizing and developing the land. The funds and space thus saved by the removal

FIG. 1. Cattle on the Grazing Camp, Mandvi *Pinjrapole*, Kutch

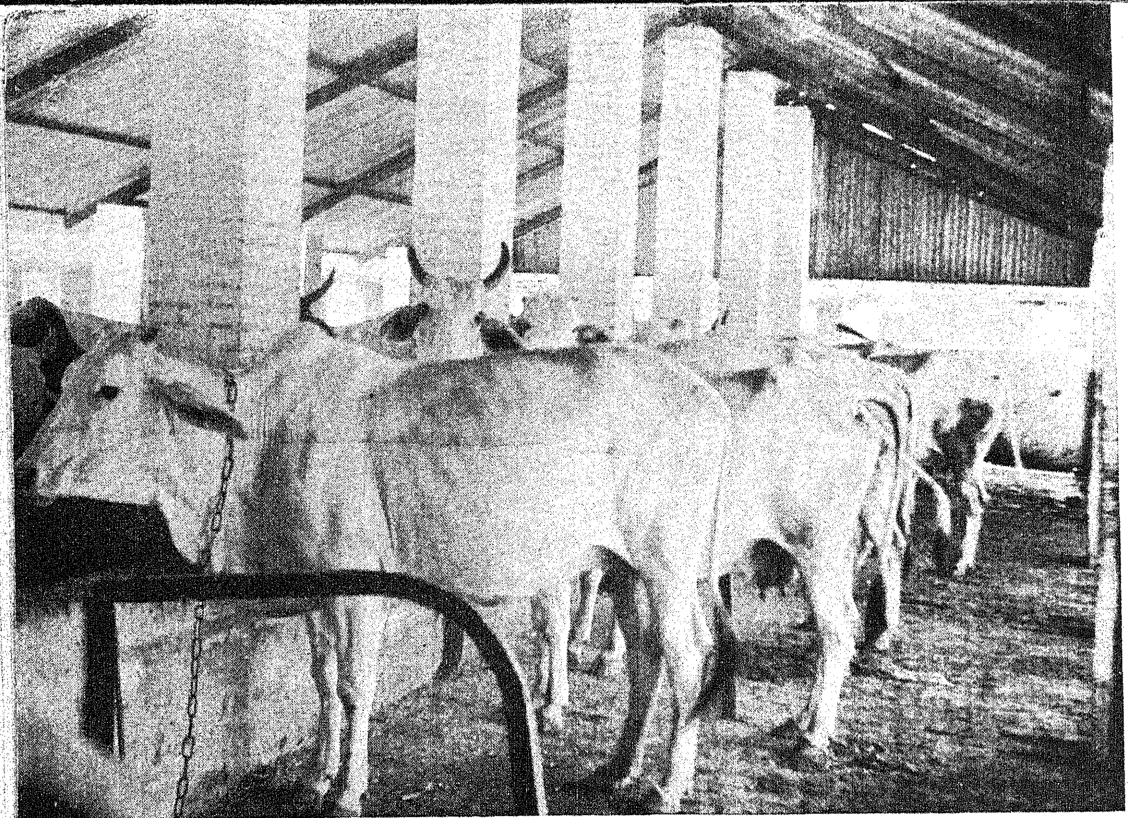
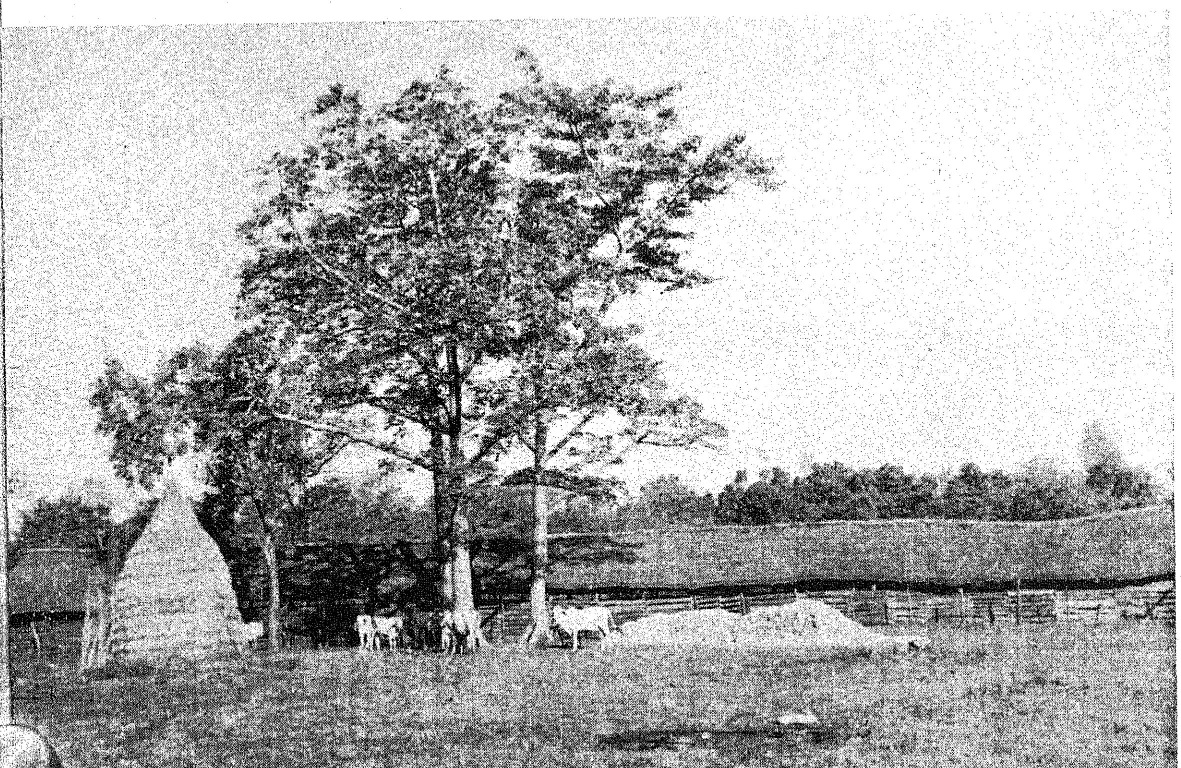


FIG. 2. Milking herd. Kanpur *Gaushala*

FIG. 3. Cattle Segregation Camp, Pashulok—Rishikesh



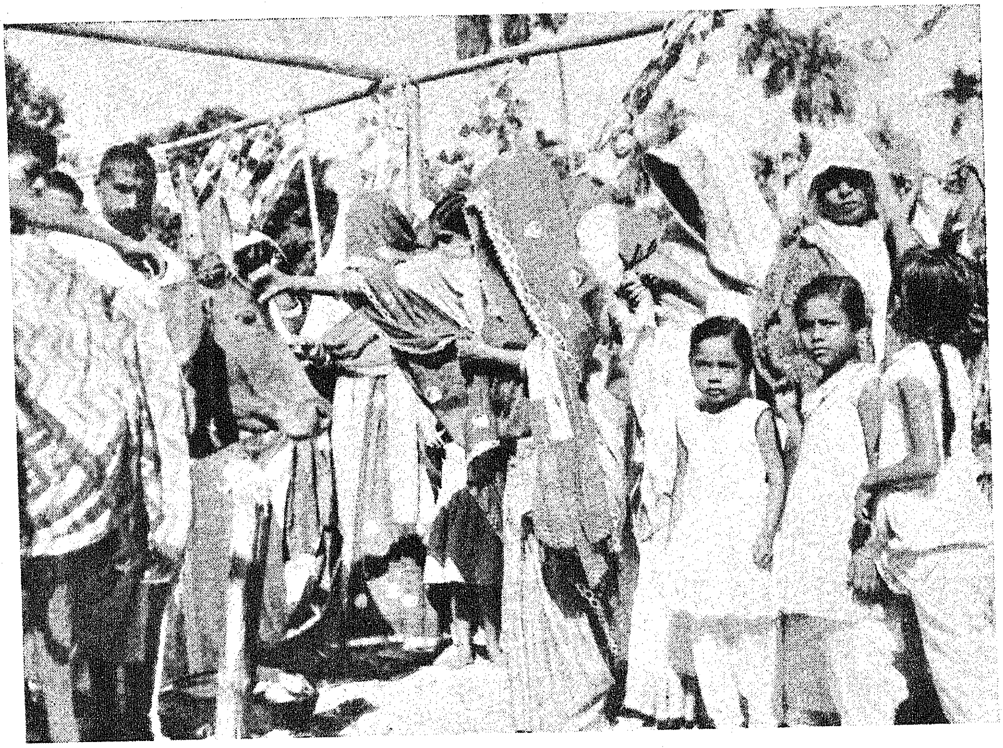


FIG. 4. Gopa-asthami Day. Gopal *Gaushala*, Dibrugarh, Assam

of useless stock can be more economically utilized for the upkeep of productive animals. Such cattle segregation camps or *Go Sadans* can be located in different zones in each province wherever suitable facilities are available. Provision should be made to castrate all males in these *Sadans* so that no further propagation takes place among these animals. The skin, bones and other offals of animals which die their natural death should be properly utilized.

For the upgrading of the productive stock, improved bulls of desirable breeds should be maintained in the *gaushalas*. Better feeding and management will go a long way in improving the yield of the milking herds.

(2) *Training of* gaushala *workers:* For efficient management of *gaushalas*, it is absolutely necessary that the persons in charge of these institutions should be trained and qualified in the handling and management of cattle. Due to dearth of technical and trained personnel it has been found difficult by the managements to effect improvements in their institutions. Efforts should be made by the *gaushalas* to get workers trained in suitable centres which are being started by the Provincial Governments in some of the provinces.

(3) *Provincial* Gaushala *Federation:* In order to develop these institutions on a, more or less, uniform standard of working, Provincial Federations of *Gaushalas* should be formed in each province and State Union. In an activity like this, where development of a large number of public institutions is concerned, formation of such non-official organizations is not only desirable but essential. These Provincial Federations may eventually have a Central All-India Federation to further coordinate their activities. Table II will give the names and addresses of the Federations already working in various provinces and States:

TABLE II

Gaushalas *working in different provinces and States*

Name of the province or State	Address	Date of formation
Ajmer-Merwara	The Federation of *Gaushala* and *Pinjrapoles*, Ajmer-Merwara, Ajmer	November, 1945
Assam	Assam Prantiya *Gaushala Sang*, Gauhati	April, 1949
Bihar	Bihar Provincial Federation of *Gaushalas* and *Pinjrapoles*, Sadaquat Ashram, P.O. Dighaghat, Patna	December, 1945
Bombay	Bombay Provincial Federation of *Gaushalas* and *Pinjrapoles*, C/o Bombay Humanitarian League, 149, Shroff Bazar, Bombay 2.	August, 1945
Central Provinces	Provincial *Gaushalas* and *Pinjrapoles* Federation, C/o Gau Sewa Sangh, Gopuri, Wardha	November, 1946
Cutch	Cutch Federation of *Pinjrapoles*, Anjar, Cutch	January, 1949
East Punjab and Delhi	East Punjab and Delhi Gau Sewak Sangh, C/o Delhi *Pinjrapole* Society, Katra Tabacco, Delhi	December, 1948
Jaipur State	Jaipur Rajya Gosewa Samiti, C/o Raja Mandal Office, Sikkar, Jaipur State	October, 1946
Orissa	Provincial Federation of *Gaushalas* and *Pinjrapoles*, Orissa, Cuttack	November, 1945
United Provinces	U.P. Federation of *Gaushalas* and *Pinjrapoles*, Naya Tola, Bareilly, United Provinces	May, 1947
West Bengal	Provincial Federation of *Gaushalas* and *Pinjrapoles*, C/o Calcutta *Pinjrapole* Society, Calcutta	December, 1948

(4) *Control over funds:* The main source of income of these institutions is the public charity collected on voluntary basis. In most of the markets a cess called *Dharmada*, *Laga* or *gaushala Katauti* is deducted on the sale of principal commodities. Depending upon local conditions the rates vary from commodity to commodity and market to market. But unfortunately a substantial part of the money deducted as *Dharmada* is not rightly spent and its actual payment to the *gaushala* funds rests entirely on the discretion of the person who collects. It is, therefore, very necessary that public opinion should be raised against the malpractices prevalent in the collection and distribution of *gaushala* cess. More effective check over the keeping of accounts and expenditure is also very necessary. In some of the provinces efforts are being made to pass legislative measures for the control of the funds and property of these institutions. Experience will show as to the desirability of following such measures in other provinces.

In the end, it may be stated that in spite of many apparent drawbacks and handicaps from which these institutions are suffering, they could, if organized on proper lines, very well serve as useful centres for improvement of cattle and milk production. The financial resources of most of them are ample. Generally these institutions are manned by influential local business community who work with religious fervour and zeal. They have in addition public sympathy. What is needed, therefore, is proper guidance so that they may be put on correct lines and be able to implement effectively the existing efforts in the development of the cattle wealth of the country.

SOUTH AMERICAN PLANTS TESTED IN AUSTRALIA MAY IMPROVE TROPICAL PASTURES

AN expedition sponsored by the U. S. Department of Agriculture in co-operation with the Australian Council for Scientific and Industrial Research visited South America (Argentina, Araguay, Paraguay and S. Brazil) last year. These are the home of many natural pasture legumes. One of the problems of tropical areas in Australia is the inability to establish satisfactory legumes.

About 400 samples collected by the expedition are under observation near Brisbane and the Australian scientists are engaged in the selection of the most promising types for large scale trials.

During 1947, 825 varieties of seeds and plant material were received from 31 overseas countries by the Plant Industry Division of the Commonwealth Scientific and Industrial Research Organization. An equal number of seed samples was sent out. Pasture and forage plants comprised the greatest number of Australia's importations.—*Australian Agricultural Newsletter*, No. AGN/269.

PRODUCTION OF VIRUS-FREE SEED POTATOES

By R. S. VASUDEVA and T. B. LAL

VIRUS diseases of potatoes are prevalent wherever the crop is grown. They not only cause appreciable reduction in the yield but are also responsible for the degeneration of seed stocks. Observations on the prevalence of virus diseases in the hills and plains of Northern India show that the incidence varies in different tracts, but is very high in many places. All the commercial Indian potato varieties have been found to be heavily infected. Most of these diseases are carried in the tuber but diseased and healthy tubers cannot generally be distinguished from each other. The virus symptoms can only be observed on the plant raised from the infected tuber. It is therefore important to produce virus-free potato seed, the use of which will increase the yield of potatoes per acre considerably. The statistical reports from Canada* show that yields secured from certified crop are nearly doubled. The problem of production and multiplication of disease-free potato seed has therefore an important bearing on the 'grow more food' campaign.

Important viruses

Work on the virus diseases of potatoes has been in progress in the Division of Mycology and Plant Pathology of the Indian Agricultural Research Institute, New Delhi, for the last eight years but had received little attention in India during the earlier past and the information as regards the occurrence of viruses in the commercial Indian varieties was meagre. As a result of research at the Institute, the occurrence of six important viruses namely, Solanum viruses 1,2,3,6,8 and 14 (Potato viruses X,Y,A,D,F and Leafroll virus) has been shown. Almost all the plants of commercial potato varieties are found infected with Solanum virus 1. Solanum viruses 2 and 3 commonly occur in combination with Solanum virus 1. To study the reaction of Indian varieties of potatoes to different viruses and for further analytical work it is necessary that the potato variety under experiment be initially free from virus infection. Work to produce virus-free nucleus of two important commercal Indian varieties, namely, *Phulwa* and *Darjeeling Red Round* which would also serve as basis for Seed Certification purposes was undertaken in 1941-42 at Delhi.

Early trials

In the winter of 1941 apparently healthy plants of *Darjeeling Red Round* and *Phulwa* growing in the fields were selected. Seed tubers of these varieties had been obtained from Darjeeling and Patna respectively. The selected plants were bagged and were kept under constant observation for visible symptoms of infection. Any plants which, at one stage or the other, were found apparently diseased were rejected. In February, 1942, the plants were finally selected and their yields stored separately.

Further trials

In 1942-43 season, 54 tubers of *Darjeeling Red Round* and 101 tubers of *Phulwa* raised from the plants selected in the field during the previous season were grown in pots containing well-manured sterilized soil in an insect-proof house. As soon as the plants were about four inches high they were examined every day for visible symptoms and were later periodically tested on differential hosts, e.g. *Nicotiana tabacum* L., *Datura stramonium* L., and *Capsicum annuum* L., for virus content. Four plants of *Darjeeling Red Round* out of 54 plants and 8 plants of *Phulwa* out of 101 remained apparently healthy till the end and also failed to produce symptoms of infection on the differential hosts. The remaining plants of both varieties, however, showed Negligible mottle and were discarded. The

* Tucker, J. (1937). The value of Seed Potato Certifications to the Potato Industry. *Amer. Potato J.* 14; 39-45.

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yield of the plants which so far appeared disease-free was retained for further tests.

During 1943-44, individual tubers of *Darjeeling Red Round* and *Phulwa* obtained from selected plants were again planted in pots in the insect-proof house. All the tubers from one plant were raised in a unit. The plants from such tubers were kept under observation from day to day and as before tested on differential hosts. In *Phulwa* variety the progenies of all the eight plants selected during 1942-43 exhibited faint mottle, at one stage or the other, which was due to Solanum virus 1. In the case of progenies of five plants, however, one or two plants in a unit were found to be apparently healthy throughout this period though the other plants in the same unit were diseased. These plants produced doubtful symptoms of infection on the differential hosts. Their tubers were therefore retained for further tests.

Production of a virus-free nucleus

In the case of selections of *Darjeeling Red Round* progenies of three plants out of four showed Negligible mottle in 1943-44 and were therefore discarded. All the progenies, numbering 17, of the remaining one plant, however showed no symptoms of disease. The plants had developed vigorous growth with green well-expanded leaves. These were repeatedly tested on the differential hosts but failed to infect them. Grafts were also made on *Datura stramonium*, *Nicotiana tabacum* and potato variety *Epicure* but no symptoms of disease were observed on any of the test plants.

One lot of the tubers of *Darjeeling Red Round* raised from each of the 17 selections was planted in units in the insect-proof house at Delhi in October, 1944. The remaining tubers were planted in April, 1945 in a well-isolated plot at the Central Seed Potato Certification Station, Kufri (Simla hills), located at 9,000 feet, in order to multiply the material. The plants, raised in the insect-proof house at Delhi continued to be examined and to ensure their freedom from disease, were again tested on the differentials but they proved to be disease-free. The plants showed vigorous and sturdy growth. The origin of these plants is traced to a single parent tuber and they now provide the nucleus for a stock which is proposed to be increased and in time is likely to replace the present infected seed stocks of *Darjeeling Red Round* variety.

PRIME MINISTER ON FOOD

SPEAKING at a luncheon given in his honour at New York by the Overseas Press Club of America, Pandit Nehru said:

'India's primary need to-day is food. In a couple of years we shall be self-sufficient regarding food as we have in hand big multi-purpose schemes, some of them even bigger than the Tennessee Valley project. But our immediate need is tractors, machinery and fertilizers. We want food at prices we can afford. The price structure is governed essentially by the price of wheat. We would like to have some of the surplus wheat of America '.

Pandit Nehru declared that India particularly wanted to create a reserve of wheat so that it could keep down prices in India. 'Secondly, we want machinery and technical assistance. We have technical skill up to a certain degree in India, but what we want is a know-how of the type that America can afford to give us in carrying out our huge development projects.'—*Food Bulletin*, October 24, 1949.

PROTOZOA AFFECTING THE SHEEP AND GOATS IN INDIA

By H. N. RAY

IN recent years the interest of Indian farmers has been directed towards the raising of sheep and goats in the country. Of late several sheep and goat breeding farms have been started in the various parts of the country.

Amongst various diseases, such as bacterial, viral or verminous, the diseases of protozoal origin are of no mean order. In this short note, therefore, an attempt is made to acquaint the farmer as well as the controlling authorities with some of the chief protozoan diseases that are likely to interfere with the normal progress of breeding farms. To define a protozoan is a difficult task but for practical purposes it is sufficient to know that it consists of a speck of living substance, the protoplasm, with a single regulating centre, the nucleus. It is due to this apparently simple organization that the name 'protozoa', which means 'primitive animals', was applied to this group of organisms. It may be mentioned at the very outset that diseases due to protozoa in sheep and goats have received very little attention in India. Excepting a few stray records of some blood and intestinal protozoa from sheep and goats* no serious attempt has so far been made to determine as to how far these organisms are responsible for economic loss to the country. Another object of this note, therefore, is to invite information from the field on various points mentioned in the text.

Coccidiosis

The most important protozoan disease known to affect adversely the sheep and goats, particularly of young age, is coccidiosis. Protozoa of the group (*Eimeria* invade the intestinal tract and often produce conditions that lead to the fatal end of the host. Several forms such as, *E. arloingi, E. faurei, E. intricata, E. ninakohl vakimovae, E. longispora, E. parva, E. ah-sa-ta, E. granulosa, E. pallida, E. arkhari and E. crandallis* have been recorded from sheep and goats of various parts of the world. Of these the first four species have been seen by the writer to occur in Indian ovine and caprine hosts. *E. arloingi* is stated to be the most dangerous one which may often cause heavy mortality (20 to 30 per cent or even 60 to 90 per cent) amongst lambs and kids. The disease may appear with the onset of rains and at times persists throughout the year as a stall, or pasture infection. Low-lying wet pastures serve as favourable ground for the persistence of the infective stage—the oocyst. In stall, the infection spreads through the medium of contaminated fodder. Experimental observations indicate that oocysts maintain their viability even after ten months at near-freezing temperature while at 40°C. they perish after an exposure for three days. Inferior quality of food, faulty feeding, faulty weaning, exposure to cold after shearing, complete changes of living conditions as in change of location, transfer to another herd, unfavourable weather and inbreeding are some of the factors that lower the resistance of the susceptible animals and thus promote the rapid multiplication of coccidia in the walls of the intestine. Recovered animals serve as 'carriers' of infection for months and as such they usually do not manifest any symptoms of the disease.

The affected animals show symptoms of the disease within two to four weeks after infection. Appetite is impaired and symptoms of anaemia followed by emaciation soon appear. There is foul-smelling obstinate diarrhœa usually without hæmorrhage. Symptoms of extreme weakness and convulsions also appear in acute cases and within a few weeks the animal dies from exhaustion.

* Baldrey, 1906 : Iyer, 1933 ; Achar and Srikantiah, 1934 ; Sarwar, 1935 ; Das Gupta, 1935 ; Ray and Raghavachari, 1941 ; Kat, 1943 ; Ray 1938, 1945.

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In lambs death may occur in a few hours. Conclusive diagnosis of the disease can only be made by detecting microscopically numerous oocysts, the potential infective stage of coccidia in the fæces, but the history and the presence of obstinate diarrhœa may lead to a tentative diagnosis. In latter cases confirmatory diagnosis is essential in order to deal with the situation adequately. In certain cases confirmatory diagnosis is not made till post-mortem examination.

A concept that should be helpful to farmers and clinicians concerns host-specificity of the coccidia, or their specific host affiliations. It is now a well-known fact that coccidia of rabbits and birds do not grow in the members of the bovine family, and vice versa.

The farmer can check the spread of the disease if he keeps a vigilant eye on the sanitary and hygienic conditions of his farm. Here are a few important hints: (1) Infected pastures should be closed down for at least six months; (2) litter should not be allowed to accumulate in the stall; (3) fodder should not be allowed to come in contact with the litter-strewn area in the stall and (4) food in the stalls should, as far as possible, be served on raised, clean and dry troughs. Above all, it must be remembered that moist conditions are ideal for the sporulation and preservation of viability of oocysts in the fæcal pellets that infected animals carry to the feed.

In recent years the usefulness of sulphaguanidine in the control of coccidiosis in lambs has been pointed out by Foster, Christensen and Haberman (1941). One to two grams of the drug given daily (with one day interval between each week) for four to six weeks completely stopped elimination of oocysts in the fæces. Sulphamezathine so useful in controlling bovine and poultry coccidiosis may also be found useful in cases of bovine and caprine coccidiosis.

In spite of all that has been said above, control of coccidiosis constitutes a topic difficult from many angles. For example, it is not known, (a) why feeder sheep and goats sometimes experience severe outbreaks; (b) is it the concentration of animals and resulting increase in the chances of heavy infection? (c) or, is it partly the metabolic change attributable to heavier feeding of concentrates that makes the host more susceptible?

Giving due regard to all sides of the problem, the author suggests that data ont he following lines should, in the first instance, be collected in collaboration with the Indian Veterinary Research Institute.

(1) Incidence of coccidiosis in sheep and goat breeding farms in India.

(2) Determination of species of coccidia.

(3) Climatic conditions that favour coccidiosis.

(4) Breed susceptibility of coccidiosis.

Another type of protozoan disease in sheep and goats that may call for attention is piroplasmosis (Babesiasis and Theileriasis).

Babesiasis

The protozoa concerned in this disease are placed under the genus *Babesia*. These organisms invade the red blood corpuscles of the host. The following species have so far been noted to occur in India: *B. motasi*, *B. ovis*, *B. sergenti*, *B. taylori* and *B. foliata*. *B. motasi* infection in sheep produces symptoms which are very much similar to those of 'red-water' in cattle. There is fever, loss of appetite and profound anæmia. The urine becomes coffee-coloured. In *B. foliata* infection in sheep, however, hæmoglobinurea is absent but high fever, anæmia and deterioration of general condition are well-marked. Pathogenesis due to *B. taylori* infection in goats is doubtful, while *B. sergenti* and *B. ovis* are not known to produce recognizable symptoms. The dropping-off tick, *Rhipicephalus bursa*, is the transmitting agent of *B. motasi* in Rumania, but as this tick is not known to occur in India, attention may be diverted towards some other species of ticks.

Theileriasis

On rare instances infection in sheep and goats with *Theileria ovis* and *T. hirci*, has been recorded from India. In natural cases in Serbia, *Rhipicephalus bursa* is suspected to be the transmitting agent. With regard to India no information is available till now.

Whether or not piroplasmosis is a major problem for sheep and goat breeding farms in India is a question which requires thorough investigation. It is therefore recommended that information on the following points be collected in collaboration with the Indian Veterinary Research Institute.

(1) Incidence of piroplasmosis in sheep and goats.

(2) Determination of species of protozoa concerned.

(3) Determination of arthropod vectors.

Surra

Occasional outbreaks of surra due to *Trypanosoma evansi* infection is not an uncommon occurrence amongst sheep and goats in India. Affected animals show progressive anæmia and emaciation while the body temperature remains normal to sub-normal. Appetite is never impaired. Death is sudden and comes within two to three weeks after infection. Breeding farms located within a surra zone shall always be exposed to the possibility of infection spreading to the farm when the surra season is on. Adoption of fly control and prophylactic measures well in advance of the expected surra season will be found to be very helpful in avoiding any calamity.

Species of *Anaplasma*, *Bartonella* and *Grahamella* have often been encountered in the routine examination of blood smears of sheep and goats in this Institute. Whether they play any pathogenic role or not is a point which has yet to be elucidated. However, it is important that data concerning the incidence of these organisms in various sheep and goat breeding farms in India be accumulated in order to signify further action.

In conclusion it may be emphasized that the Indian farmers should come in close contact with their fellow brothers working in the laboratory and with mutual cooperation help to build up a fund of knowledge that will serve as a guiding force for the eradication of diseases from the country. Almost all the provinces in India have now their own officer specially deputed to investigate disease problems in sheep and goats and a reference to the respective Animal Husbandry Department will bring this special officer in direct contact with the disease problems, who in return, if necessary, will invite expert opinion on the subject. The village *panchayat* can thus form a very useful link between the stock-owner on one hand and the laboratory worker on the other. Needless to say that a great uphill task yet remains to be fulfilled before we are in a position to view the situation in proper perspective.

AUSTRALIAN FIELD BEAN FERTILIZER TRIALS

TRIALS with field bean crops in the New England and district of New South Wales, Australia, have shown that yields can be trebled by application of various fertilizers and elements.

A trial on granite soil was sown on $3 \times 3 \times 3$ factorial design, with three levels each of nitrogen, superphosphate and potash, and with split plots of molybdenum and no molybdenum. The only significant increases in yield were obtained from superphospate and molybdenum.

The 2 cwt. dressing of superphosphate gave an increase of 2·1 bushels over the 1 cwt. dressing, while a 3 cwt. dressing gave an additional increase of 2·9 bushels. Sodium molybdate at 3 lb. to the acre gave an increase of 3 bushels to the acre. Yield in the different plots ranged from 34 to 42 bushels an acre, nearly three times the normal yield.

On red basalt soil, none of the minor element treatments, either with or without lime, gave worthwhile increases in yield. A minor element trial on grandiorite soil showed increased yields from borax and molybdenum treatments, but lime applications had little effect.—*Australian Agricultural Newsletter*, No. AGN/265.

COMMERCIAL POULTRY FARMING—AN UNECONOMIC PROPOSITION IN ASSAM

By B. K. DAS

POULTRY farming on a commercial scale has not, so far, been a success in Assam, due mainly to higher production cost of eggs and birds in a farm as compared to the price of marketed village products.

Handicaps like high rainfall, high incidence of disease, high wages of local labour, dearth of foodstuffs, etc. have also been responsible to some extent for the failures. These factors are discussed briefly below with the help of data obtained from the records of A.O.C. Farm, Digboi, and Government Farms of Assam.

Market price of eggs and birds in Assam

The price of eggs and birds varies from season to season in Assam and is generally lowest during the cold season and highest from August to October, the difference in price being as much as 50 per cent.

Depending on availability and locality, fowl eggs sometimes fetch slightly higher price than duck eggs. But duck eggs are more in demand as they give more food value per rupee (average weight of duck eggs is $1\frac{3}{4}$ oz. and of fowl eggs is $1\frac{1}{2}$ oz.), and are preferred by the majority of the population, the Hindus.

Fish is a strong competitor against eggs and birds in this province and its availability has a direct influence on the demand and prices of these foodstuffs.

Within these limitations and variations, the average wholesale price of eggs and birds in the urban markets of Assam valley from 1942 to 1947, is given in Table I.

To compare with these prices, the cost of production of eggs and birds in a farm have been taken from the records of A.O.C. Farm, Digboi. The cost of same in Government Farms of Assam will be similar, if not higher.

Cost of production of eggs

In computing this the feed cost per laying bird over a year plus cost of labour and upkeep and average yield of eggs per bird per year have been taken into consideration.

TABLE I

Average wholesale price of eggs and birds (1942–47)

Year	Price of 100 eggs. Average for the year		Price per fowl (table size). Average for the year		Price per adult duck. Average for the year		Remarks
	Rs.	as.	Rs.	as.	Rs.	as.	..
1942	4	8	1	2	1	4	
1943	7	0	2	0	2	4	Prices went high due to war
1944	9	8	2	14	3	0	do.
1945	9	8	2	14	3	0	do.
1946	7	8	2	0	2	0	do.
1947	7	8	1	8	1	12	Price of eggs fluctuated very much due to transportation difficulties

Feed: Feed given to each bird daily has been 2 oz. paddy as scratch food and 2 oz. of the following mixture as mash using as far as practicable only those foodstuffs which are common in Assam.

Mixture

1 part wheatbran
1 part broken rice
1 part crushed *matikalai* (black gram or *urd*)
5 per cent fish meal or dried fish or boiled meat scrap
$2\frac{1}{2}$ per cent mineral mixture and grit

The average prices of these foodstuffs and of the above-mentioned mixture for the five years 1942 to 1946 are given below. The value of green feed which has been mostly farm grown

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lettuce and vegetable leaves, has not been taken into account.

TABLE II

Average price of foodstuffs and grain mixture (1942-46)

	1942	1943	1944	1945	1946	Remarks
	(Per maund)					
	Rs. as.	Rs. as.	Rs. as.	Rs. as.	Rs. as.	
Paddy	4 0	6 0	7 8	7 8	7 8	
Matikalai (crushed)	6 8	11 0	15 0	15 0	12 0	
Wheatbran	5 8	5 8	5 8	5 8	8 0	Direct import from Calcutta
Broken rice	6 0	9 0	12 0	12 0	10 0	
Fish meal or meat scrap	20 0	30 0	40 0	40 0	40 0	
Mineral mixture	15 0	15 0	18 0	18 0	18 0	
Feed mixture	6 13	9 9	12 0	12 0	11 3	

When wheatbran went out of stock ricebran was substituted, but as price of the latter ranged between Rs. 3-8 to Rs. 5-8 per maund, there was little saving of money on that score.

Cost of labour: This has been calculated on the basis of one man for 200 birds, based on the author's experience in the A.O.C. Farm, Digboi. His duty includes:

(1) Cleaning of 10 houses (with 20 birds in each) with attached runs and also feeding utensils once daily. Time taken $4\frac{1}{2}$ to 5 hours usually.

(2) Bringing food from godown and feeding the birds four times daily (scratch food twice, once dry feed and once mash).

(3) Collecting vegetable and lettuce leaves from the field for feeding the birds.

(4) Collecting eggs, several times in a day.

(5) Hoeing one of the runs by turn every day for burying the soiled surface of the runs.

(6) Attending sick birds, when necessary.

All these duties usually keep the man fully employed for the day.

Allowance has to be made over and above this for sickness (in a malarious country like Assam), leave, Saturday and Sunday overtimes, etc.

Wages of an ordinary labourer during the five-year period, 1942 to 1946, have been as follows:

		Rs. as.
1942	...	1 0 per day
1943	...	1 4 „ „
1944	...	1 8 „ „
1945	...	1 8 „ „
1946	...	1 8 „ „

Cost of rearing males: As the selling of setting eggs and breeding stock were also included in the programme of the farm, the cost of rearing male birds has also to be taken into consideration. For producing table eggs only this expense could be dispensed with except when suitable replacements for culled birds were unavailable locally. In Digboi almost all the improved hens were mated, but in a big commercial farm mating of more than 50 per cent of the birds may prove to be unnecessary. Taking this figure as the basis for calculation and taking that one cock will be needed for every 10 hens in the average, (light and heavy breeds combined), the cost of feeding and labour for males comes up to 1/20th of that of hens in a year. The cost of production of eggs will, therefore, increase in the same proportion.

Cost of replacement of laying stock: The economic life of a laying hen is rather short, rarely more than three years, often less, the best laying periods usually being the 'pullet' and the succeeding year. Hence, replacement of stock is essential at least every third year. In actual practice this is a gradual process, averaging, say, one-third of the total stock per year and is always attended with some loss as the disposal value of the birds is usually far below their initial price. An idea of this loss will be obtained from the following figures: Stock maintained say, 100 hens. Initial cost @ Rs. 5 each=Rs. 500. Transactions at the time of replacement:

Receipt	Expenditures
Value of 33 hens culled out @ Rs. 2 each = Rs. 66	Cost of 33 hens as replacement at the end of the year @ Rs. 5 each = Rs. 165
Loss in a year = Rs. 99	
Rs. 165	

It is therefore seen that for every 100 hens maintained in the farm, there is a loss of about a rupee per bird per year at the time of replacement.

Other charges: These include remuneration

of Supervisor, medicines, rents and taxes, interest on capital, depreciation on houses, etc.

In A.O.C. Farm, Digboi, where more than 1,200 birds were kept at any given time, for about three years, these charges have been found to be Rs. 2-4 or so, per bird per year.

Actual expenditure was calculated as follows:

(a) Remuneration of Supervisor @ Rs. 65 per month ...Rs. 780

(b) Medicines ... ...Rs. 80

(c) Rents and taxes on 20 acres @ Rs. 4-14 per acre ... Rs. 97-8

(d) Interest on capital:

(i) Value of 1,200 birds @ Rs. 4 average = Rs. 4,800

*(ii) 60 houses and runs, bamboo and thatch, @ Rs. 80 each = Rs. 4,800

*(iii) Staff quarters, bamboo and thatch = Rs. 1,200

(iv) Equipments = Rs. 300

Rs. 11,100

@ 3 per cent (Savings account interest) ... Rs. 333

(e) Repairs and depreciation on houses, (average life of thatch when cane or similar leaves are used, eight years; of bamboo walls of poultry houses with proper eaves, five years; of bamboo posts, one year; and of bamboo fence of runs, when fixed 2 in. to 3 in. above ground, three years; average life of all items combined about five years) say, 20 per cent of the cost = Rs. 1,200

(f) Miscellaneous (including loss from breakage of eggs between laying and marketing) = Rs. 200

Rs. 2,690-8

Rs. 2,690-8 ÷ 1,200=about Rs. 2-4 per bird per year.

Loss arising out of deaths and casualties: Even in very well-managed farms, death stalks in and casualties occur in spite of all precautions. Losses through these two factors are variable and may reach up to 10 per cent or more of the stock in some cases, but under normal conditions and under favourable circumstances, it should be possible to keep them down to 5 per cent or less. Taking this latter figure as the basis for calculation, it is seen that for every 100 birds, there is a loss of about Rs. 25 per year, @ Rs. 5 per bird. It works out at four annas per living bird per year.

Total cost of upkeep

The total cost of upkeep for a hen over a year during 1942 to 1946 is given in Table III after adding up the above-mentioned items of food, labour and other charges.

TABLE III

Cost of upkeep of a hen (1942-46)

Year	Cost of food Rs. as. p.	Cost of labour Rs. as. p.	Proportionate cost of rearing males Rs. as. p.	Cost of replacements Rs. as. p.	Other charges Rs. as. p.	Loss through death and casualties Rs. as. p.	Total Rs. as. p.
1942 ...	6 1 3	1 13 0	0 6 3	1 0 0	2 4 0	0 4 0	11 12 6
1943 ...	8 12 0	2 4 6	0 8 9	1 0 0	2 4 0	0 4 0	15 1 3
1944 ...	10 15 6	2 11 0	0 10 9	1 0 0	2 4 0	0 4 0	17 13 3
1945 ...	10 15 6	2 11 0	0 10 9	1 0 0	2 4 0	0 4 0	17 13 3
1946 ...	9 13 6	2 11 0	0 10 0	1 0 0	2 4 0	0 4 0	16 10 6

Yield of eggs

The average annual yield of eggs per bird for the years 1937-38 to 1945-46, have been taken from the records of the A.O.C. Farm, Digboi, and from those of the Government Farms of Assam and are given below:

* All houses were made of bamboo and thatch, because it was cheap and rearing poultry was an experimental and war-time enterprise.

TABLE IV

Average annual yield of eggs per bird

	1937–38				1938–39				1939–40			
	Rhode Island Red or White Leghorn	Crosses	Local Hens	Ducks	Rhode Island Red or White Leghorn	Crosses	Local Hens	Ducks	Rhode Island Red or White Leghorn	Crosses	Local Hens	Ducks
A.O.C. Farm Digboi	×	×	×	×	×	×	×	×	×	×	×	×
Upper Shillong Farm	150	138	×	×	115	108	70	81	Record unavailable			
Sylhet Farm	×	×	×	103	×	×	×	60	do			
Khanapara Farm	×	×	×	×	97	×	×	87	do			
Pukra Duck Farm	×	×	×	×	×	×	×	70 (in 6 months)	do			
Titabar Farm	×	×	×	× ×	×	×	×	×	×	×	×	×

	1940–41				1941–42				1942–43			
	Rhode Island Red or White Leghorn	Crosses	Local Hens	Ducks	Rhode Island Red or White Leghorn	Crosses	Local Hens	Ducks	Rhode Island Red or White Leghorn	Crosses	Local Hens	Ducks
A.O.C. Farm Digboi	×	×	×	×	113	×	67	*45 *(in 4 months)	114	76	66	89
Upper Shillong Farm	132	×	×	×	×	×	×	×				
Sylhet Farm	×	×	×	×	×	×	×	×				
Khanapara Farm	×	×	×	×	×	×	×	×				
Pukra Duck Farm	×	×	×	130	×	×	×	×				
Titabar Farm	×	×	×	×	×	×	×	×				

	1943–44				1944–45				1945–46			
	Rhode Island Red or White Leghorn	Crosses	Local Hens	Ducks	Rhode Island Red or White Leghorn	Crosses	Local Hens	Ducks	Rhode Island Red or White Leghorn	Crosses	Local Hens	Ducks
A.O.C. Farm Digboi	106	72	40	76	123	67	×	×	112	81	×	×
Upper Shillong Farm									124	×	×	×
Sylhet Farm									100	×	96	×
Khanapara Farm									96	87	63	81
Pukra Duck Farm									×	×	×	150
Titabar Farm									87	×	×	×

Note: All laying records of Government Farms have been taken from the *Annual Reports* of the Agricultural Department of Assam. No report was published for the years 1941 to 1945.

The average yield per bird per annum thus comes to :

Rhode Island Red or White Leghorn ...	113
Crosses	90
Local hens	67
Pukra farm ducks	140
Local ducks	79

The yield of 113 eggs per year from an improved hen in Assam is lower than that obtained in farms of Northern India, where the average annual yield per hen reaches up to 140 in some cases. It is extremely doubtful if the yield of eggs in Assam will ever equal that of Northern India.

However, for the sake of comparison, both the figures of yield, viz. 113 and 140 are taken into consideration in the following Table for calculating the cost of production of 100 fowl eggs during the years 1942-46. Market prices of eggs of the respective years are also shown side by side for reference.

TABLE V

Cost of production of hundred fowl eggs during 1942-46

Year	Annual total cost of up-keep per hen	Cost of 100 eggs @113 eggs per year	Cost of 100 eggs @ 140 eggs per year	Average market price for 100 eggs
	Rs. as. p.	Rs. as. p.	Rs. as. p.	Rs. as. p.
1942	11 12 6	10 6 3	8 6 3	4 8 0
1943	15 1 3	13 6 0	10 12 0	7 0 0
1944	17 13 3	15 12 3	12 11 9	9 8 0
1945	17 13 3	15 12 3	12 11 9	9 8 0
1946	16 10 6	14 11 9	11 14 3	7 8 0

From the foregoing Table it is seen that, during the quinquennium mentioned, the cost of production of eggs is higher than the market price by almost 100 per cent in the case of 113 egg yield and by exactly 50 per cent in the case of 140 egg yield per hen per year. The difference/loss in both cases is very high and is normally insuperable under Assam conditions even if the bigger size of eggs from exotic birds and higher price of setting eggs are taken into consideration.

These two points are now discussed in detail below:

Bigger eggs from exotic birds: These eggs are bigger than local hen's eggs, but are usually no bigger than duck's egg. In special markets, like that of Digboi or Shillong where there are many European buyers, a limited number of these eggs can sell at a higher price, specially as the supply is very limited at present. But ordinarily these eggs will have to contend with three factors:

(i) The limited buying capacity of the majority of the local inhabitants;

(ii) the allurement of cheapness of the local hen's eggs in spite of their comparatively smaller size ;

and (iii) competition from cheaper duck eggs which are as big as exotic hen's eggs and are quite liked by all sections of the inhabitants for table purpose.

During the years of his management of the A.O.C. Food Stall in the Digboi bazar, the author has repeatedly found that even the Mohammedan buyers, rich or poor, preferred duck eggs to fowl eggs for ordinary daily use, due to the greater value the former gave for their money. They are likely to employ the same monetary standard when making their choice between cheaper duck eggs and dearer fowl eggs of equal size. The result will be lesser demand for the latter. Moreover, with the dwindling of the European population with their greater buying power the fancy price of exotic hen's eggs is also likely to disappear.

Higher price of setting eggs: Eggs for setting no doubt fetch higher price, but what will be that price, specially when more than one farm operate in the same area? And what percentage of the production can be sold as such? Will the proceeds be enough to cover the expenses incurred in producing the eggs? These points are now discussed one by one.

(i) *Price:*

The A.O.C. Farm sold eggs for setting to the inhabitants of Digboi @ as. 4 each from 1941 to 1945, when the market price of table eggs ranged between one anna and three pies to one and half anna each. The price of setting eggs in Government Farm varied between as. 4. to as. 8 each for urban buyers according to demand and availability. A price higher than as. 4 per egg was found to be beyond the reach of the local inhabitants

in general and so in mass production of setting eggs higher price expectation will be unjustified.

(ii) *Percentage of production that can be sold for setting:*

In Assam, the demand for setting eggs is more in the cold season which is propitious for hatching and when the eggs possess more vigour and fertility and also retain them longer.

In a commercial farm in Assam, where hatching season is limited by rainfall and climate; about 30 per cent of the yearly production, i.e. nearly all the fertile eggs produced in the cold season (November to February) may, *at the very most*, be expected to be sold as setting eggs.

(iii) *Sale proceeds of setting eggs* versus *production cost:*

It has been seen that cost of production of table eggs exceeds market price by about 100 per cent under Assam conditions. In order to recoup this loss, the number of eggs sold for setting must of necessity be at least 40 per cent of the total production (which is 10 per cent higher than actual availability) and their price should not be less than Rs. 25 per hundred. Even then, profit for the owner would remain unrealized, for which selling of about 60 per cent of the eggs as setting would be needed. But this is too great an expectation in Assam, as season, climate, local market conditions and possible competition are all against it.

Cost of production of duck eggs

The cost of feeding ducks which consume about 2 oz. more food per head daily is about 50 per cent higher than that of fowls and as ordinary ducks yield about 30 per cent less than improved fowls, the overall cost per 100 duck eggs is enhanced by almost 100 per cent when compared to that of fowl eggs. Even when the yield of duck eggs in Pukra Duck breeding station is taken into account (140 eggs per bird per year) the cost of duck eggs remains about 10 per cent higher than that of fowl eggs. Under farm conditions ducks have been further found to produce greater number of infertile eggs and to be more susceptible to nutritional diseases and changes of food and environments.

Thus it is seen that production of eggs, either of improved fowls or of ducks, in a commercial farm in Assam, is an uneconomic proposition even when bigger size of eggs from exotic birds and higher price of setting eggs are taken into consideration. The position would be far worse if local or mixed breeds with lower laying capacity were also kept in the farm.

Cost of production of table birds or breeding stock

In calculating this the following items have been considered:

(1) *Cost of setting eggs:* In the A.O.C. Farm, Digboi, it averaged as. 2-3 each during 1941-45. It is quite a reasonable figure of cost for eggs produced in a commercial farm in the province.

(2) *Hatchability of eggs:* Normal hatchability of eggs was 70 per cent in the case of hen's eggs and 50 per cent in the case of duck eggs. This lesser hatchability increased the cost of setting egg by more than 6 pies.

(3) *Cost of incubation:* This worked out at about as. 2 per chick hatched out when a broody hen was used for hatching. This is arrived at by dividing the feed cost of the bird (about Re. 1 for a month) by the number of chicks (average 7 to 8 hatched out per setting). The cost of machine incubation will be equal to it, if not higher.

(4) *Mortality in chicken:* This is usually 40 per cent (often more) from birth up to adult age due mostly to too wet climatic conditions, chicken pox and faults in the foster-mother. It adds up to the cost of production of the surviving birds. Most of the deaths occur before the chicks have reached three months age, when cost of feed is lesser than in the subsequent period. Therefore, under normal conditions, the monetary loss is estimated at roughly 10 per cent of the total cost of upkeep of the surviving birds.

(5) *Feed cost:* The calculation of this is based on routine employed in the A.O.C. Farm, Digboi, and is as follows:

For 100 chicks	Feed given	Value
		Rs. as. p.
3rd day after birth to 10th day	Average 3 lb. daily of 2 parts broken rice and 1 part wheat-bran	2 10 0

For 100 chicks	Feed given	Value
		Rs. as. p.
	Brought forward	2 10 0
11th day to 3 months age or 90th day	Average 9 lb. daily of 2 parts broken rice, 1 part broken *matikalai*, 1 part wheatbran and 5 per cent fish meal	103 1 0
3 months to 8 months age	Average 12 lb. daily of adult feed mixture and 6 lb. daily of paddy as scratch food	305 2 0
	* Total	Rs. 410 13 0

Rs. 410-13-0 ÷ 100 = about Rs. 4 per bird up to 8 months age. Value of greens have not been taken into account as these were mostly offals of the vegetable plots of the farm and cost nothing except the labour of collection.

(6) *Labour cost and other charges:* Labour cost is slightly more in the case of young and growing birds as they need proportionately more care and attention than adults. But, in their case other charges are on the other hand low, as interest on capital and depreciation on houses are less applicable because, farm-bred birds have no purchase-value, and need for less space than adults for most of the growing period. Now, an adult bird costs about Rs. 4-8 in labour and other charges per year (Table III). At this rate it will cost Rs. 3 in 8 months. With this figure in mind, it is estimated that from birth to 8 months age a farm-bred bird will cost roughly Rs. 2-8 in labour and other charges.

All the above-mentioned items added together, bring up the cost of production per bird to about Rs. 7-8, calculated as follows:

		Rs.	as.	p.
(a)	Cost of setting eggs	0	2	3
(b)	Increase in cost of hatching due to infertility of eggs	0	0	6
(c)	Cost of incubation	0	2	0
(d)	Feed cost	4	0	0
(e)	Labour and other charges	2	8	0
(f)	Increase in cost due to mortality, 10 per cent of the total costs in items (a) to (e)	0	10	9
	Total Rs.	7	7	6

or say, Rs. 7-8 per bird at 8 months age.

The average market price of table birds is Rs. 2-8 in this province. Compared to this, the cost of production of a farm-bred bird is three times as high and is an entirely uneconomic proposition for table purpose. In the case of breeding stock, the average sale price of a farm-bred cockerel was Rs. 7-8 and of a pullet Rs. 5 in the A.O.C. Farm, Digboi, for individual buyers during 1941-45. When cockerels were sold in numbers to the tea estates the wholesale price was between Rs. 5 and Rs. 6 per bird. Birds sold from Government Farms equalled these prices mostly, or were sometimes more in special cases. The above prices were fair and still hold good. Thus it is seen that in Assam, the selling of farm-bred birds as breeding stock is not also likely to bring any profit to the owners.

Handicaps

The chief handicaps are the following :

(1) Heavy rainfall (112 inches average over the province), spread over about eight months in the year, which hinders the range-feeding and general well-being of the birds.

(2) Diseases, most common being internal and external parasites which thrive very easily in the equable climate of the province. Other diseases to be dreaded are Ranikhet, Fowl-cholera and Chicken-pox, Paralysis of legs, cannibalism and eating of eggs are also common when there is defective nutrition.

(3) Dearth and high prices of foodgrains, such as paddy, broken rice and *matikalai*, which are also essential human necessities. From the national point of view too, it is uneconomical to feed these foodgrains to

* All calculations have been made according to average price of foodstuffs for 1942-46 as per Table III.

poultry in preference to human beings as the calorific value of these foods, when fed to the birds, is not recovered in their eggs or meat. The following comparison of calorific values of foodgrains, egg and meat will illustrate this.

Calories in foodgrains given per year to each bird				Egg produced by each bird	Meat for table per improved fowl	Meat for table per Indian duck
Paddy 45 lb., i. e. rice 32 lb. @ 99 calories per oz.	Rice 15 lb. @ 99 calories per oz.	*Matikalai* 15 lb. @ 96 calories per oz.	Total per year	113×2 oz. @ 42 calories per oz.	3 lb. @ 30 calories per oz.	3 lb. @ 50 calories per oz.
50,688	23,760	23,040	97,488	9,492	1,440	2,400

(All calorific-values taken from *Food* by Robert McCarrison).

It is seen that by ingesting 97,488 calories poultry can produce only either 9,492 in eggs or 2,400 in meat. Maximum total utilization is therefore only about 12 per cent of the intake, the rest being wasted.

(4) Cost of high wages, augmented by the irregular attendance and inefficiency of the local labour.

Conclusion

From the foregoing discussions regarding the market price of eggs and birds, their production cost in the farms and the handicaps, the hard fact emerges that in Assam a commercial poultry farm has to struggle against heavy odds and has practically no chance of success under the existing conditions.

The author therefore feels that the interest of the province would be best served by encouraging and improving village products, by providing facilities for timely inoculation of improved stock and by organizing speedy and safe transport for eggs and birds during their transit from rural to urban areas.

TWIN CHICKENS FROM DOUBLE-YOLKED EGG

A BOYHOOD ambition to hatch twin chickens from a double-yolked egg has accidentally been achieved by an Australian poultry farmer. He estimates that getting twin chickens is a million to one chance.

The farmer is Robert Wilson of St. Ives, New South Wales, who has hatched 500,000 chickens. In August 1949, while handling eggs from an incubator, Mr. Wilson was surprised to see one egg chipped on both sides. He handled the egg carefully and gave the chicks a little help to break the shell. Now he has twin Chinese Langshan chickens. They are abnormally small and are being mothered by a hen.

The twin chickens came from a brown-shelled egg weighing 2-3/4 oz. Chick sexers say that double-yolked eggs usually weigh about four ounces but it is rarely that both yolks are fertile.—*Australian Agricultural Newsletter*, No. AGN/265.

ECONOMICS OF POULTRY-KEEPING

By S. G. IYER

IN India at present there is no system of guaranteed prices and promising markets for eggs and poultry nor is there any exhaustive periodical bulletin giving publicity of the current economic position, as an aid to the fixation of prices. Prices for eggs and table poultry are not controlled, the farmer gets very little profit for his produce and the middleman makes the best of the business by exploiting the consumer. A good deal of useful work in the line is being undertaken by the Marketing Departments and there is considerable scope for improvements. Price fixation of eggs or poultry demands accurate knowledge of the production costs. In the absence of systematic surveys on regional basis, the country being extensive, it is indeed difficult to quote accurate figures with respect to rearing, feeding and other costs of production. On specialized farms budget figures have to be announced as forecasts and it is becoming more and more important to institute cost accounts dealing with the different aspects of poultry husbandry separately. Where poultry are kept as a side line to other livestock or agricultural enterprise it is still more difficult to assess labour and other costs. Experience has shown that there is an ocean of difference between the present costs and pre-war costs. To contribute some reliable information on the current costs of production of eggs, the records (1945-46) of the Poultry Research Section of the Indian Veterinary Research Institute, Izatnagar have been analyzed and the data collected form the basis of this article.

Stock

Rhodes being hardy and dual-purpose breed, the records of this breed have been considered. Pure-bred and pedigreed ready-to-lay pullets were trapnested for a period of 365 days. They were housed in angle iron bar wire-netted houses protected from sun and rain by *chuppers*. The birds selected for the experiment were bred on the Institute Farm from an Australian strain imported in 1939.

The pullets hatched in the month of January, came into lay in August or September; from November onwards cock birds were added to the pen of pullets with a view to produce fertile eggs and flock mating was practised.

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Management

The birds were fed grain and mash rations together with protein, mineral and green supplements and the composition of the cereal rations fed throughout the period, i.e. from the time the birds laid the first egg to the end of the first year's production is as follows :

Mash		*Parts by weight*
Wheat bran	...	35
Yellow maize meal	...	35
Ground oats	...	10
Groundnut cake	...	19
Salt	...	1

Grain mixture

Yellow maize grit, Paddy, *Jowar* } equal parts

Half the mash mixture was fed as dry mash in waste-proof hoppers to which the birds had free access. The remaining half was fed as wet mash by adding to the dry mash cooked meat offal 1 oz. per bird. The grain mixture was broadcast on the ground morning and evening. In addition all the birds were given *ad lib* limestone grit of suitable sizes and available greens at the rate of about two ounce per bird.

Cost of production

The post-war data (1946) furnishing the cost of production are shown in Table I.

To give a true picture of the actual costs, a correction has been made by eliminating the birds which died before the end of the first year. Actually the mortality for one year amounted to five per cent only.

All eggs produced during November to March were used or sold for hatching while those laid during the remaining portion of the year were sold for table. Loss of eggs due to accident or other factors was less than 0·5 per cent and has therefore been ignored in the calculations.

TABLE I

Costs and returns from pullets

Expenditure			Returns	
Item	Quantity	Total cost of production Rs. as. p.	Item	Cost Rs. as. p.
Ready-to-lay pullets	50	300 0 0	Table eggs 4,000 @ Rs. 1-8 per dozen	500 0 0
Cock birds	4	60 0 0		
Rent of land	1/4 acre	6 0 0	Hatching eggs 4,000 @ as. 8 per egg	2,000 0 0
Depreciation of fencing, house and equipment at 10 per cent per annum		47 12 0	Sale of cock birds	60 0 0
			Sale of hens after deducting depreciation	240 0 0
Depreciation of hoppers, fountains and trap-nests at 20 per cent per annum		18 0 0	Manure	5 0 0
				2,805 0 0
Depreciation of *chupper* at 50 per cent per annum		25 0 0		
Food*		884 5 0		
Labour charges—feeding, egg recording and other work		54 0 0		
Cleaning and disinfection		27 0 0		
		1,422 1 0		

* Details are given in the Appendix.

Results

Table I gives the costs of production and returns from 50 Rhode Island Red pullets. The total cost of production of approximately 8,000 eggs during a period of one year from the 50 birds after deducting the usual depreciation charges on permanent structures, works out to Rs. 1,422. The cost, therefore, per dozen of eggs, fertile as well as infertile, under the experimental conditions is Rs. 2-2 although in some of the cities such as Naini Tal, Delhi, Madras, Bombay and Calcutta there is good market for eggs, the retail prices ranging from Rs. 2 to Rs. 3 per dozen. The producer hardly gets more than Rs. 1-8-0 per dozen on wholesale basis. This is the situation when purebred pedigreed birds have been maintained for purposes of commercial, i.e. table egg production. At this rate producing eggs solely for table may not be a profitable concern under specialized farm conditions but the situation can be improved. At least 50 per cent of the total annual production should be in the form of fertile eggs and this number can be readily obtained during the peak production period between November and

March, the breeding season in Northern India. Temperton* in a study of post-war costs of turkey production stated that food represented a major item of expenditure constituting 50·4 per cent and 44·1 per cent of the total cost of production in first and second hatches respectively. He analyzed also the cost of day-old poults and labour: about 32 and 14·5 per cent respectively. In the present experiment the food costs amounted to Rs. 884 or 62 per cent of the total cost of production. The cost of the birds works out to 25 per cent of the total cost of production and in the absence of authentic information on rearing costs it is hard to conceive that if one starts from purchased eggs at Rs. 12 or so per dozen it would be more profitable than purchasing ready-to-lay pullets. In the figures quoted in Table I a sum of Rs. 6 has only been paid as the cost per pedigreed pullet which in the opinion of the writer is, however, reasonable. Labour charges account for slightly less than 4 per cent of the total cost of production.

At the end of the first year of production the general practice on specialized farms is to retain 1/3 of the layer population which had laid well and dispose of the remaining birds for breeding or table purposes. The layers after one year of laying have therefore a resale value, same in the case of cock birds. A small amount can also be realized from the sale of manure. Not taking into account the sale value of the birds and manure, the return from the sale of eggs, table as well as hatching, is Rs. 2,500 against the total cost of production of Rs. 1,422, which means a definite net profit. On the other hand if all the eggs produced were sold as table eggs only, the total amount that could be realized from the produce would be only Rs. 1,000 leading to a net loss of Rs. 422 although a sum of Rs. 305 could be realized from the sale of birds, etc. The greater the number of hatching eggs sold in the season the greater will be the profit.

Issue of permits for cereals to recognized poultry-keepers and campaign to put an end to black markets will, it is hoped, help a long way to cut down the food costs. The system of feeding in this experiment is an ideal one for getting maximum production. Any departure from this, with a view to cut down the costs in all probability, will adversely affect the production. With small holders or back-yard poultry-keepers, poultry-keeping costs little as in such cases indeed no account is made for fallen grains, insects, greens, house scraps, etc. to which birds usually have access and free labour which is usually available from the wife or the children in looking after the birds.

Summing up poultry farming can be made an economic proposition in this country by producing eggs for table as well as for hatching purposes.

* Temperton, H. (1947). *Harper Adams Utility Poultry J.*, 32, 4-8

Appendix

Food costs

	Rs.	as.	p.
Wheatbran 875 lb. @ 10 lb. per rupee	87	8	0
Yellow maize meal 875 lb. @ 8 lb. per rupee	109	6	0
Oats 250 lb. @ 6 lb. „ „	41	10	0
Earthnut cake meal 475 lb. @ 5·4 lb. „ „	87	8	0
Salt 25 lb. @ 8 lb. „ „	3	1	0
	329	1	0

Grain

	Rs.	as.	p.
Jowar 833 lb. @ 10 lb. per rupee	83	5	0
Yellow maize 833 lb. @ 8 lb. per rupee	104	2	0
Paddy 833 lb. @ 6 lb. per rupee	138	13	0
	326	4	0
Limestone 1,000 lb. @ Rs. 2–8 per 80 lb.	31	4	0
Meat offal 1,250 lb. @ Rs. 0–1–3 per pound	97	11	0
Greens 2,500 lb. @ 25 lb. per rupee	100	0	0
	228	15	0
Total	884	4	0

What the Scientists are doing

CARDAMOM RESEARCH

THE Indian Council of Agricultural Research is financing a scheme which is calculated to give scientific assistance to the cardamom industry in Madras Province. It came into operation on 1 April, 1944 and is due to terminate on 30 September, 1952. The object is to devise ways and means of controlling the pests and diseases of cardamom and thereby restore the yields to normal. The yield of cardamom is said to have deteriorated from an average of 100 lb. per acre to 35 lb. or less making the cultivation of the crop unprofitable.

Pests

The major pests of cardamom are 'Thrips' which produce scab on the pods. They are also suspected to cause shedding of pods and also to play the role of the insect vector concerned in the transmission of mosaic disease of cardamom. Of the several insecticides tried to control 'Thrips', Nicotine sulphate as a spray and Gammaxene as dust applied once a month proved most efficient and economical.

Another insect pest of cardamom is a caterpillar boring into the shoots and pods. A third one is the swarm caterpillar which defoliates the plant. These are under investigation.

Diseases

'Clump rot' (falling off) disease of cardamom has been found to be caused by a fungus known as *Pythium vexans*. Measures to control the disease have revealed that ammonium phosphate and superphosphate help to arrest the disease and induce quick recovery of the diseased clumps.

Cardamom grown in certain regions of the province under certain conditions appears to be susceptible to 'Mosaic' caused by virus. It is proposed to study various aspects of this virus disease in future.

Nursery practices

Investigations on the nursery practices such as the effect of the soil texture on germination and stand, pre-treatment of seed on germination, most suitable mulch for the primary nursery, effect of dressing of seeds with fungicides on germination, etc. were also studied. The following results were obtained:

(1) The application of cattle manure and ash to the nursery resulted in more vigorous and taller seedlings.

(2) Treatment of seed with 0·1 per cent mercuric chloride for 15 minutes gave significantly better germination.

(3) Of the various types of mulch tried for the primary nursery, grass mulch proved the best and the final stand under this treatment was significantly high.

Breeding

Selection was made with a view to produce strains with higher yield, and other desirable characters such as thick round pod, high oil content, etc. The oil of cardamom is very valuable in commerce and medicine.

The oil content of five of the high yielding selections is given below:

Selection No.		Percentage oil	
		Dry weight basis	Wet basis
10	...	3·63	1·20
56		2·90	0·87
78	...	3·70	1·02
87	...	3·60	0·99
88	...	2·40	0·72

The above figures show a wide range of variability in the oil content and the selection

is in progress for this character. As regards yield, eight selections have been consistently better than the controls in three successive seasons. The percentage of increase in their yield over the local variety of cardamom is given below:

Selection No.	Average percentage of increase over local in three seasons
39	32
Ceylon	35
41	44
89	55
81	111
71	132
87	136
50	139

It will be seen that on an average performance extending over three successive seasons, four selections have given increased yields over the locals ranging between 32 and 55 per cent while the other four have given even greater yields varying from 111 to 139 per cent.

Another set of 23 promising selections with high yields have to be tested further. (R.S.)

COLD EXTRUSION PROCESS USED FOR BUTTER

THE Australian Dairy Production Board is experimenting with an entirely new design of butter making machine, which has been installed at the Glenormiston butter factory in south-west Victoria. If the experiments are successful, it may revolutionize the manufacture of butter.

This machine, an Australian in invention, has been manufactured by a Melbourne firm. It is unique in that it uses the extreme cold extruding process instead of churning in the manufacture of butter.

Milk is handled in the usual way until after it passes through a separator. Then the cream is piped to a special cream separator, which divides it into eighty per cent butterfat and twenty per cent butterfat skim. Butterfat is carried to a vat which standardizes it for salt and moisture content. During the process a portion of the skim is fed back into the butterfat. Then, under vacuum pressure, the butterfat enters the extruder where, in a brine solution at a temperature below zero, it is transformed into butter. The butter comes out of the machine at a temperature of 30°F.

The Glenormiston factory is one of the best in Australia. Its assets are worth £A82,000, and the shares in the company which controls it are owned by local dairymen. It uses about 35,000 gallons of milk a day, to make butter, cheese, skim milk and dried butterfat. During the past year, the factory has won six first prizes in State competitions, including the grand aggregate of points for butter factories.—*Australian Agricultural Newsletter*, No. AGN /265.

You ask We answer

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and States. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. What steps has the Government taken to make available to the cultivator adequate supplies of manure for his fields.

A. There are mainly two types of manures by the use of which crop yields in our country can be considerably increased, viz. (a) organic manures and (b) chemical fertilizers. We are at present importing about 1½ lakh tons of these chemical fertilizers from foreign countries. There is a world shortage of these and we can get no more than this quantity from outside, for the present. In our own country we are producing about 50,000 tons of artificial manure in our existing factories. All this is only a flea-bite. Much of it is priced too high for the ordinary agriculturist. The famous fertilizer factory of Sindri, yet in the making, is expected to produce 3½ lakh tons of fertilizer per year. And yet if we consider the total needs of our country we must set up in India as many as 50 such Sindri factories. We must, therefore, at the same time turn our attention to the utilization of our urban and rural organic waste materials which can be converted into organic manures so useful for increasing the fertility of our soils.

Q. In the villages the cultivators feel a shortage of fuel for cooking purposes and cow dung cakes are used for this purpose. What is he to do if he uses it in the manure pit ?

A. It is criminal to use cattle dung except for manuring. This will enable him to get increased crop production from his poor soil and he will help the Government and the country in meeting the important problem of food. The Government has been considering the cultivator's problem of fuel and have launched a campaign for planting of quick-growing trees all over the country to provide an alternate source of fuel to the cultivator for his requirements. As a result of this drive 20,51,140 quick-growing trees were planted in various provinces and States on the Independence Day observed on 15 August, 1948 and 31,750 acres have been put under forest trees to meet the need. It is hoped that the cultivators themselves would help in this direction and spare all their dung for manuring of crops.

AN AMENDMENT

Indian Farming, Vol. IX, No. 11, November, 1948 : Page 460, Col. 2. In para 2 of the answer furnished to the question appearing on this page, it was stated that 'no work has been done on the feeding of plantain leaves and trunks to animals in this country'. There is, however, a publication on this subject—Leaflet No. 1 of 1919, entitled : '*Plantain Stalks as Fodder for Cattle in Famine Years,*' issued by the Department of Agriculture, Bombay. We are thankful to Mr. W. B. Hayes of the Agricultural Institute, Allahabad, for drawing our attention to this publication—*Editor*.

DEVELOPMENT OF AGRICULTURAL MARKETING IN INDIA*

THE Royal Commission on Agriculture in India laid stress on the importance of improvement in the field of agricultural marketing. The recommendations made by the Commission were subsequently reiterated by the Indian Banking Enquiry Committee in 1931. The Marketing Committee of the United Nations Conference on Food and Agriculture held in October, 1945 at Quebec also recognized the importance marketing plays in the agricultural economy of a country. They said 'Marketing is the crux of the whole food and agricultural problems. It would be useless to increase the output of food, it would equally be futile to set up optimum standards of nutrition unless means could be found to move food from the producer to the consumer at a price which represents a fair remuneration to the producer and is within the consumer's ability to pay. Similar considerations apply to other agricultural products and to fish and forest products'.

In accordance with the recommendations of the Royal Commission, the Government of India constituted the Central Agricultural Marketing Department in 1935, now known as Directorate of Marketing and Inspection, for undertaking the necessary marketing surveys and for making a beginning on the lines broadly indicated by the Commission. With the help of contributions made by the Central Government, the Provincial Governments were enabled to set up similar marketing organizations and arrangements were made for carrying out the survey work under the technical guidance of the Agricultural Marketing Adviser to the Government of India. The cooperation of a large number of Indian States was also sought and obtained in this connection.

Survey reports

Fifty-eight survey reports, brochures, bulletins, etc. were published between 1935 and 1948. Five were published in 1948 and eight are under compilation. Most of the reports are out of stock and revision of five reports was also undertaken in 1948. It may be mentioned here that there was a setback in the progress of writing survey reports during the War period in view of the fact that the services of experienced marketing staff were utilized by the Provincial Civil Supplies Departments for the procurement and distribution of controlled commodities.

In the various survey reports so far published by the Agricultural Marketing Adviser to the Government of India, inherent flaws in the marketing systems, as are prevalent in the country, have been brought to light and various recommendations made, such as (i) grading and standardization of agricultural and livestock products, (ii) regulation of markets, (iii) standardization of weights and measures, (iv) regulation of quality of exports, (v) development of foreign trade, (vi) cooperative marketing, (vii) establishing licensed warehouses, (viii) standardization of contract terms, (ix) regulation of Agricultural Produce Exchanges, etc. Besides these, there are various other problems, such as, communication and transport, financing of agricultural marketing, storage and maintenance of market statistics and news service.

The Agricultural Produce Grading and Marking Act, 1937

This was enacted to provide for the fixation of grade standards for agricultural and livestock products and for the grant of Certificates of Authorization to private persons and corporate bodies to grade agricultural and livestock products on the basis of these standards. Under the provisions of this Act, grade specifications have been drawn up and notified for some 22 commodities and some of the commodities graded under Agmark during

* Report of the Directorate of Marketing and Inspection up to December, 1948.

1948 alone were valued at nearly 12 crores of rupees, as under:

	Value of quantity graded (in rupees) in 1948
Ghee	3,59,50,372
Butter	34,09,811
Edible oils	93,20,382
Eggs	3,92,943
Tobacco	4,99,64,945
Sugarcane *gur*	78,849
Cotton	76,74,258
Sann hemp	1,16,23,435
Fruits	2,34,329
Potatoes	5,120
	11,86,54,444

The Agricultural Produce (Grading and Marking) Act, 1937, is a purely voluntary measure and as such there is no provision for any control on the quality of agricultural products that are exported. Complaints from the foreign consuming countries have been innumerable. With a view to enhancing the reputation of Indian agricultural produce in foreign countries, the introduction of a Bill for regulating the quality of export of any agricultural produce was taken up for consideration. In the meantime, the Central Government can prohibit under Section 19 of the Sea Customs Act the export of agricultural produce unless they are graded in accordance with Agmark standards. The Section 19 of the Sea Customs Act is now effective on tobacco and sann hemp which cannot be exported unless graded in accordance with Agmark standards. The resultant salutary effect of this has been the high reputation of Agmark tobacco, for example, in the foreign markets and a large number of tobacco growers are coming forward to form themselves into cooperatives with the object of pooling their produce and selling the same after grading in accordance with Agmark standards.

With a view to exploring the foreign markets for Indian produce, samples of a number of products (where possible graded under Agmark) were sent to the Indian Government Trade Commissioners abroad to contact the trade in their respective countries. Encouraging results have been obtained, particularly in respect of tobacco, cashew kernels, Hand-Picked Selected groundnuts, wool, etc. It was also proposed to control the quality of lac, Hand-Picked Selected groundnuts, wool and goatskins meant for export.

Regulation of markets

A model Bill on the regulation of markets was prepared and circulated in 1938 to the various provinces and States, in many of which it formed the basis for requisite legislation. Bombay, Central Provinces and Berar, Madras, East Punjab and the States of Mysore, Hyderabad, Baroda, Gwalior and Patiala have already made legislations for this purpose. Bombay has prepared a five-year plan to regulate more than half of the markets in that province. A Bill for regulation of markets in Centrally Administered Areas was prepared some time ago, but it was decided that instead of introducing a separate enactment in the Central Legislature, the Administrations in Delhi, Ajmer-Merwara and Coorg be advised to adopt one of the provincial legislations on the subject.

Standardization of weights and measures

The Central Government passed the Standards of Weights Act in 1939. Thereafter all the provinces were requested to enact suitable legislations for regulating weights and measures based on standards. Bihar, Bombay, East Punjab, Central Provinces and Berar, Orissa, Coorg and United Provinces have already enacted legislations for this purpose.

Licensed warehouses

The provinces of Central Provinces and Berar and Bombay and the Travancore State have passed suitable legislations for the establishment of licensed warehouses.

Cooperative marketing

Very little has so far been achieved in this direction and a review of the development of cooperative marketing of agricultural produce in India was undertaken with a view to suggesting further lines of development.

Standard contract terms

Standard contract terms on an all-India basis were drawn up for white wheat, linseed

and groundnuts (kernels for crushing) particularly with the object of securing a suitable premium or better quality produce.

Futures trading

With a view to checking speculation, a draft Bill for regulating the operations of Agricultural Produce Exchanges was prepared. The Bill also provides for the adoption of standard contract terms for trading both in 'ready' and 'futures' markets.

Inspection of foodgrains

Fair Average Quality specifications for wheat, gram, barley, *bajra*, *jowar* and maize were drawn up for the working of the Basic Plan of the Ministry of Food and the procurement and rationing programmes of the Provincial and State Administrations. A regular inspection of foodgrains purchased by the Government of India for a Central reserve is maintained along with a supervision of such inspection of foodgrains as are moving under the Basic Plan or Rationing Scheme. Check inspections with regard to quality and weight are also carried out at convenient points. Inspection of imported grains discharged at various ports is also being attended to. (Contributed by the Directorate of Marketing and Inspection.)

JAMMU AND KASHMIR

JIA LAL RAINA

FOR some time after the partition it became difficult to obtain a supply of Diesel Oil—an insecticide for the control of San José scale, which is an important insect pest of the deciduous fruit trees in Kashmir. The trees remained untreated and were subjected to the ravages of San José scale. The export of fruits was also adversely affected; the fruits perished to the detriment of the interests of poor orchardists.

The Department of Agriculture has already taken up steps to supply the zamindars with the insecticide with the timely assistance of the Dominion of India. The Government of India has been prompt enough to arrange a supply of 40,000 gallons of Diesel Oil. There has been an increasing demand for this insecticide and many orchardists, who were loth to use it before, came forward to receive their quota.

With the help of the Indian Union arrangements are being made to ensure better marketing of the fruits produced in the State. It is proposed to introduce Cooperative Marketing System whereby the produce will be delivered direct to the consumers thus eliminating the middlemen who at present grab the bulk of the profits out of the transaction.

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With the advent of the popular Government in the State, special measures have been taken to improve the lot of the man behind the plough. All the fallow land is being placed under the plough; a special Officer has been appointed for this purpose. To date 85,000 acres of land have been reclaimed and brought under cultivation by tillers to whom this land has been allotted. The yield of grain from the reclaimed lands amounted to about 1,20,000 maunds during the last harvesting season. The Department of Agriculture supplied large quantities of improved seeds for such newly cultivated lands. To bring more lands under cultivation the Government has already made available two heavy tractors. Largescale tractor cultivation is being considered for Jammu Province, and it is expected that in the near future the entire fallow land in Kathua District will be put under the plough.

About 1,500 *kanals* of land have been placed at the disposal of the Cooperative Department where a cooperative farm on an experimental basis has been laid out. At this cooperative farm the authorities are providing facilities for other subsidiary industries which would keep the farmers engaged throughout the year.

On account of heavy rains, rivers and rivulets went into spate and inundated the lands at many places. The crops were destroyed not only by submergence but by the long spell of cold which followed. The paddy crop was greatly damaged and at many places the yield was reduced by 50 per cent.

An intensive campaign for growing more food is going on. Lands which were once utilized for growing fodder are now being cultivated for food crops. Waste lands and *numbal* (marsh land) areas are being improved and cultivated. All such lands are being leased out to tillers for extensive cultivation. The problems of supply of manure and improved implements are being {effectively tackled in consultation with Czechoslovakian experts who have been asked to submit schemes and proposals for installing a plant for the manufacture of ammonium sulphate.

The European vegetable seed growers were active throughout the season in raising seeds. Rains and the appearance of aphids in an epidemic form had however adversely affected the yield. Most of the seeds, that were finally collected, were exported to the Indian Union.

MULCHES FOR BULBS

FOUR years' results to date with mulches on tulips—the test crop—indicate they have certain specific value for conditions prevailing along the coastal area of British Columbia. Commercially, however, their value is still speculative as they have not been used extensively- Experimental data show a six per cent increase by weight in the marketable portion of the tulip bulb crop, and two per cent in the total bulb crop on the average. But it is considered that any general use of added mulch for bulbs will be governed by the availability, the cost of the material and application, as well as other important considerations such as the increased difficulty in weed control and harvesting operations. Based on these considerations and results, which also show an increase of 21 per cent in top grade of flowers in two years out of four but a decrease of one per cent on the average, it is concluded that mulches, in general, have restricted use for annual bulb crops such as tulips. Bulbs other than tulips, some lilies for example, which do not require to be lifted annually in order to obtain maximum crop increase and to control disease, may be found to benefit more fully from mulches than do tulips.

Other points revealed by these tests are that the bulb and flower crop benefited most in light and unimproved soils. Also, that there was no anticipated reduction in packing of heavy, clay type soils due to winter rains as judged by digging and harvesting operations in July. It was also revealed that mulches satisfactorily check soil erosion, a point not fully appreciated or answered as yet for large plantings where the system of culture usually demands three-foot ridged rows for machine operation and drainage.—*Department of Agriculture Information Service, Canada.*

WHEAT-DOCTOR STAKMAN: FAMINE'S WORST ENEMY*

By VICTOR COHN

THE 100-year-old American Association for the Advancement of Science inaugurated as its new president in January 1949 Elvin Charles Stakman, scientist, traveller, conversationalist, teacher and friend of underfed mankind. Dr Stakman is one of America's leading specialists in plant and cereal diseases, and an assiduous student of the life and habits of the organisms that cause those diseases. Simply, this means that Stakman is one of the men who make the world's wheat grow, and who thereby insure world plenty instead of world starvation.

Gray-haired, round-faced, exuberant Dr Stakman is a professor at the University of Minnesota's agricultural college which is located in the wheat belt of the United States. At the same time, he has for 20 years been a plant pathologist of the U.S. Department of Agriculture, and an expert in discovering and eliminating wheat blight and similar crop-ruining fungi. But his work has not all been on the applied level. From his researches, he has discovered and formulated laws of breeding and specialization that help microbiologists and geneticists everywhere; and from his laws of fungus specialization drug researchers have taken many a cue in their search for new antibiotics like penicillin and streptomycin—those cousins of the unfriendly wheat rust.

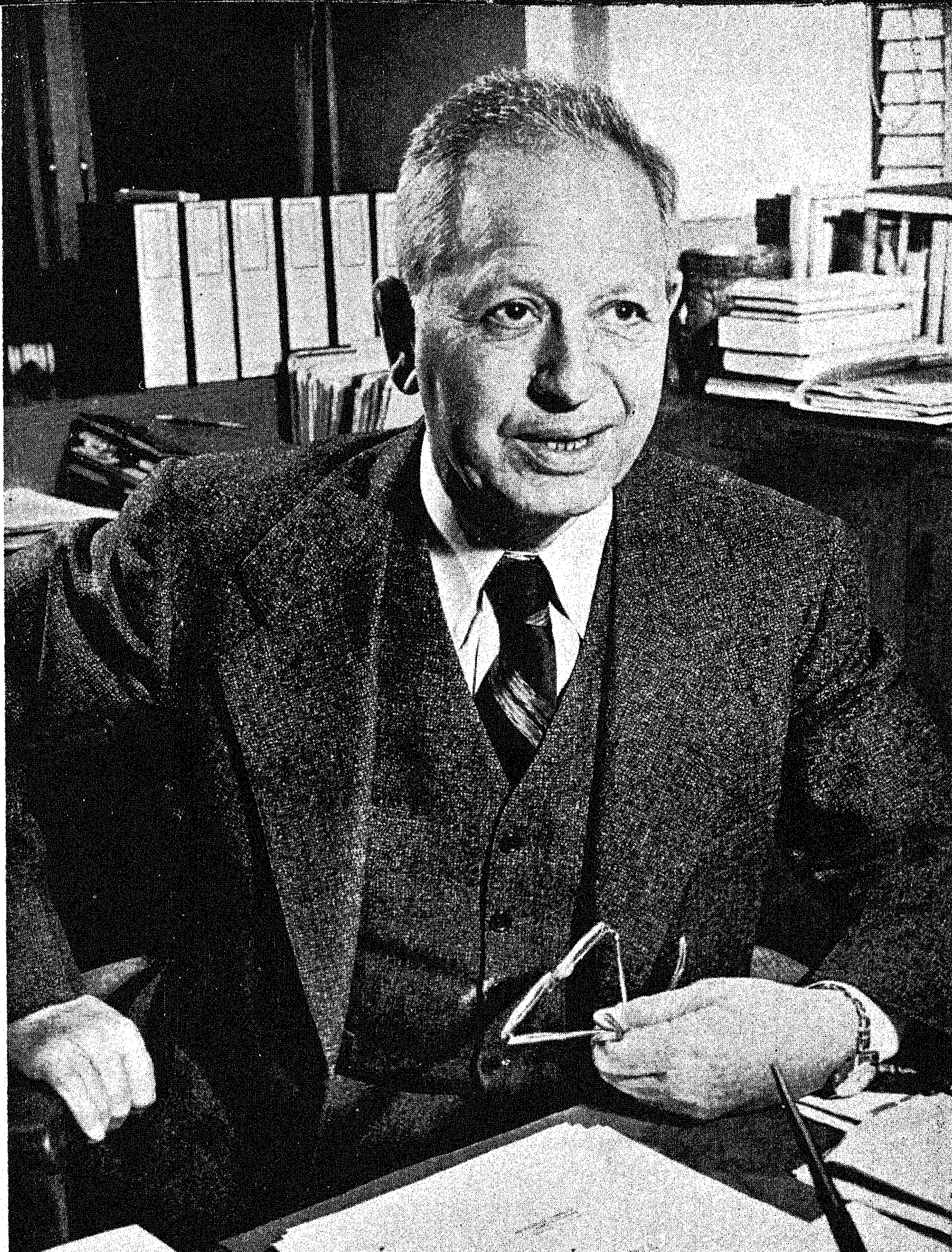
Rust, a fungus, destroys $1,000,000,000 worth of wheat every year in the United States, and occasionally explodes in disastrous epidemics. In 1916, one of these rust epidemics struck. Young Elvin Stakman, then an associate professor at the University of Minnesota and an agent of the U.S. Department of Agriculture, went out to see it all for himself. He travelled from southern Minnesota westward, touring the fields by horseback and bicycle. On a number of occasions he would ride on a casually scheduled local train, and persuade the brakeman to stop the train while he dashed into a wheat field to grab a sample of the shrivelled plant.

That autumn Stakman returned to his laboratory with suitcases full of samples from all over the wheat belt of the United States. Night after night he laboured, peering through the microscope, taking notes and analyzing his results. Wheat-rust spores seen under the microscope, he found, looked alike—simple and egg-shaped. But when he sprinkled the spores over damp young Marquis variety wheat plants, some of the spores would attack and wither them, while others would find Marquis completely resistant, but would thrive on the Bluestem or Red Fife varieties.

Clearly, reasoned Stakman, there were many races of rust within each previously known variety—enough races to be able to attack any of the wheats then being grown in the United States. And just as clearly, the only way to learn all the properties of all the kinds of rust was endlessly to sample and test specimens of wheat and rust from every part of the earth. This has remained one of Stakman's main jobs for nearly two dozen years, and today some 200 races of rust are known and identified.

Out of this information, Stakman and his associates began to revolutionize hybrid wheat breeding. They started playing genetic tricks—crosses and double crosses and back crosses between fine bread wheats and tough durums.

*This article appeared in the April 1949 issue of *Science Illustrated* published monthly in the United States by the McGraw-Hill Publishing Company. The writer is a frequent contributor to American periodicals. The accompanying photograph is courtesy of *Science Illustrated*.



Dr Elvin Charles Stakman, one of America's leading specialists in plant and cereal diseases, has helped double U. S. wheat output in the last 12 years by almost eliminating epidemic rust, the wheat blight.
(By courtesy of *Science Illustrated*)

PLATE 70

They sowed their new hybrids in disease-teeming test plots and tried to kill them with rusts. The fittest and most rust-resistant survived, and became the basis of a new series of wheats, hardy and sweet.

In his study of the life-cycle of the fungi, Stakman found that rust has a dual life. In its red-coloured phase, it attacks wheat in spring and summer, pitting the stalks, drying up the sap, shrivelling the kernels. Finally it produces black spores—the second phase of its life.

These spores have to get through the winter somehow, when there is no growing wheat to thrive on. Nature's answer, formulated long ago, was the barberry bush, on which the rust can live through the cold season. From their haven on the barberry bushes, the spores return again in the spring to the wheat, once more in the red or rust-coloured phase.

Stakman declared war on the barberry bushes. 'Clean out the barberries,' he told farmers at hundreds of meetings, 'and you knock out the rust at the most vulnerable part of its cycle'. Stakman, ever a tireless conversationalist and talker, lectured away at farmers, flourmakers, legislators, nurserymen, and horticultural societies. He urged them to burn and uproot the barberries; he urged that where barberries were needed (for decoration or for their fruits), they should be replaced with the non-rusting Japanese variety.

By 1921 a group of midwestern businessmen had organized a Conference for the Prevention of Grain Rust, and Stakman became their most effective publicity man. Since 1921, members of this group have contributed more than $500,000 from their companies' treasuries to further the work.

The joint efforts of Stakman, the U.S. Department of Agriculture and private groups, have had more than a little success. Eighteen States now have official barberry-eradication programmes in operation, and the U.S.D.A itself maintains an active anti-barberry division. About 350,000,000 bushes have been destroyed, and partly as a result of this, there have been no major rust epidemics in the United States in over a decade.

But tireless Stakman learned something else early in the fight. He found that barberry eradication is not enough—for even though the last hard-to-find bush might be spotted and burned, the tiny dust-light spores still could live and perpetuate the cycle, providing they found another winter home.

This was what Stakman was afraid of. In 1921, to find out about it, he fastened vaseline-covered slides to the wings of U.S. Army airplanes, and sent the planes off to cruise around high above the States of Minnesota, Texas and Nebraska. When the planes came down, Stakman rushed to the laboratory with his precious slides, and there saw the truth. Red-rust spores had been floating around in the air, two miles up. Putting this fact together with the best available weather information, Stakman concluded that the spores, which cannot survive the winter in the United States wheat belt (except on barberries), could travel on autumn winds all the way from Canada and northern United States as far south as Texas and Mexico. There they find ample berths in the juicy winter wheat, live out their intermediate phase, and return as new red spores the next spring, to blight and ruin the wheat of the northern plains.

Today, as a result of his discoveries, Elvin Stakman lives much of his life out of a roomy, well-scuffed suitcase. Every spring he flies to Mexico to start following the spores northward on their return to the United States. With perhaps a couple of men from the University of Minnesota and a couple more from the U.S.D.A., he travels in a U.S.D.A automobile, starting each day's journey as soon as the dew is off the grain. They drive about five miles at a stretch, then stop to scatter out into the fields and gather samples.

From these trips, Stakman and his associates have learned that central North America is an uninterrupted 2,500-mile-deep rust belt, tied together by the winds. Stakman therefore has had to leap national boundaries in his fight against the disease, and together with the Rockefeller Foundation (an organization founded by the American philanthropist to foster research) he has been encouraging the development of rust-resistant wheat in both Mexico and the U.S. 'Slow down the rust in Mexico', he explains to officials of both nations, 'and you slow it down everyplace else. After a while,

if you are lucky, the whole thing will just slowly have to peter out'.

It has petered out a great deal already. True, there were rust epidemics in the American Midwest as late as 1935, 1937 and 1938, and even in 1948 stem rust was still epidemic within some parts of a few States. But 1948's overall wheat harvest brought in an unusually large crop of 1,288,000,000 bushels—more than twice the production of 1935. In the light of the Marshall Plan, this was a great blessing. For that matter, wheat production in the United States was excellent all during the years of the last war.

Elvin Stakman's interest in plants started far back in his childhood, for he grew up as a typical farm boy in the mid-western State of Minnesota. He worked on the farm, herded cattle and clerked in a country store, but had no inkling that he was destined to spend his life as the friend of the farmer and the enemy of rust. Stakman even drifted into small-town teaching, after getting his degree in botany in 1906. He taught such subjects as history, political science, German and algebra, in addition to coaching basketball, football and track.

Eventually, however, he returned to the State university in 1909 and joined Dr E. M. Freeman's new plant pathology department—the first in the United States—as a graduate student and instructor. Freeman put Stakman to work on rust, and his future was settled.

In less than half a dozen years, he had become an employee of the U. S. Department of Agriculture, and by 1916 set forth on the first of his many tours of the wheat lands. The next year Stakman married a fellow biologist. While the Stakmans' married life has been a thoroughly happy one, it has never held Stakman back from his field trips, and he has spread the anti-trust gospel not only throughout the United States and Mexico, but all over Europe, Alaska and Australia.

The Rockefeller Foundation, taking note of Stakman's ability as a biologist, sent him off on various trips to survey agriculture and science in almost every country of Central and South America. The Firestone Tire and Rubber Company sent him on a trip to Liberia, Ceylon and Malaya, some years ago, to examine and check on rubber plantations.

The U.S. Government also asked him to look into the rubber situation in 1940; as part of the national defence programme, the U.S.D.A. wanted to know what the possibilities were of growing rubber in South America. He cruised up the Amazon in canoes to its headwaters in Colombia, Peru, Brazil and Bolivia, brought back seeds, budwood from wild rubber trees. His most recent trip was a flight to Japan, as a member of a team invited by General MacArthur to examine Japan's laboratories and scientific schooling.

Stakman's many trips have made him a thorough cosmopolite, and a citizen of the world. But essentially he is an earthy character, and one who gets along with farmers and plain folk as well as with college presidents and law-makers.

In addition to all his other activities, Stakman is a member of the U. S. Atomic Energy Commission's advisory committee on biology and medicine. In his own laboratories he is currently using mildly radioactive uranium salts to make fungi mutate. If the tests work out well, he will have found a safe and inexpensive way for laboratories to study genetics and mutation; it will eliminate costly machinery or dangerously radioactive isotopes.

Where Stakman gets all of his energy is a mystery. Possibly it comes merely from his love of his subject. Agriculture is more than a livelihood to him; it is the world's basic industry. 'Without plants, life would be impossible', he tells his students, 'and that makes the study of plant diseases a pretty important sort of work'. Stakman firmly rejects Malthusian pessimism—the theory that man is rapidly becoming too numerous for his resources.

Stakman has seen such great improvements in crop output as plant pathology takes hold, that he feels the earth's population 'probably could double without causing distress'. We certainly must use the new technology and the new science of plant health, he feels, or the world will starve—to this extent, the pessimists are right. But with agricultural science properly applied, the world could well feed any population the next century is apt to produce.

Yet he crosses his fingers about rust and the uncertain future. New races of rust are always appearing by mutation and

hybridization; and although Stakman and his colleagues have been developing wheats that resist the known rusts, those same wheats may, unknown to him, be terribly susceptible to rusts that could develop in the future.

Stakman's life has been devoted to work which may eventually change the grim picture of hunger throughout the world. Plant pathology, he believes, can and will 'safeguard the world's food supply. Maybe we shall even be able to accomplish the greatest end of all—maybe we shall be able to remove some of the fear of want among human beings.'—*Released through U.S.I.S.*

PLANS FOR INTERNATIONAL COMMODITY CLEARING HOUSE

INTERNATIONAL commodity experts have drawn up a plan for creating a world clearing house for dealing with food surpluses. It would be designed to avert the difficulties arising from the accumulation of unsold agricultural products. The scheme has been prepared at the request of the Food and Agricultural Organization of the United Nations, and will be considered at the annual conference in November.

Recommendations contained in the experts' report have been endorsed by the Director General of the F. A. O., Mr. Norris Dodd. The main proposal is for the creation of a new world organization to be known as the International Commodity Clearing House. This body would be responsible for assisting the smooth clearance of products in agricultural markets in order to forestall the danger of surpluses accumulating. Should such surpluses occur, it would have the authority to acquire them and dispose them of to the best advantage.

This organization would, in all its activities, work through the Governments who are members of the F. A. O. or through such other channels as they might approve. Membership in this Clearing House would be open to all members of the F. A. O. and the United Nations. It is suggested that it should be set up as a public corporation with a capital of $5,000 millions.

The report divides the functions of this new world agency into seven main heads. The first and second deal with the buying of surplus stocks and commodities and with negotiations for the sale of these. The other functions are concerned with the holding of stocks acquired during periods when there is a glut, with exchange commodities on a barter basis and with the arrangement of bilateral or multi-lateral trade agreements.

The experts indicate that they do not anticipate a surplus occurring in several commodities, among which are included coffee and wool. But they do envisage that the production of sugar, cotton, certain fats and oils may exceed demand within the next twelve months. During the next three years they consider that there is an almost certain prospect of surpluses occurring. (*B.I.S.*)

A GENERAL SURVEY OF THE MILK PROBLEM IN INDIA

SARDAR DATAR SINGH

MILK is an essential universal item of Indian diets and great prominence is given to the consumption of milk, either as such or as one of its products, even by the poorest in our country. Such is the present-day demand for milk that even without any organized propaganda, there is hardly any possibility of milk remaining unutilized if it can be produced in greater quantities. Milk and milk products, apart from their nutritional and economic values, are regarded as auspicial and freely used on ceremonial occasions.

A recent survey by the Agricultural Marketing Department places the total gross production of milk in the Indian Union at 5,827 lakh maunds. Of this total, 46·7 per cent is cow milk, 50·2 per cent buffalo milk, and the rest goat milk. From this if the quantity of milk fed to the calves is deducted, the net available quantity left is 4,815 lakh maunds. The import of milk products is comparatively negligible and amounts to less than six lakh maunds per annum, estimated as fluid milk. We thus obtain an average *per capita* consumption of 5·5 oz. in terms of liquid milk per day, which you will agree is too low a consumption by our modern standards for optimum nutrition which is laid down as 16 oz. especially in a country where diets lack first class proteins and are poor in essential minerals like calcium. A majority of the population being vegetarian, the main source of animal fat is milk and milk products.

To produce the quantity of milk noted above, the country maintains 41·1 million cows, 19·6 million she-buffaloes and about 8·2 million milch goats. The average milk yield of cattle is very poor which directly raises the cost of production. The Indian dairy industry is essentially a rural industry pursued as a subsidiary to the general agriculture. Nearly 95 per cent of the stock is maintained in rural areas. The intensity of milk production varies a great deal. It is the highest in places like Delhi, Baroda and East Punjab, and lowest in Mysore, West Bengal and Assam. The average quantity of milk produced per square mile, per day, for the country as a whole comes to only 83 lb. The maximum production per village comes to hardly a thousand pounds per day in Delhi Province, where the production is the highest. This will in some measure explain why it is so difficult to organize our dairy industry on the Western pattern.

SARDAR DATAR SINGH is Vice-Chairman of the Indian Council of Agricultural Research, New Delhi.

Another important point is also worth noting here. The production of milk is lagging behind the increase in human population and unless strenuous efforts are made to remedy this, the position is likely to become serious with the passage of time. The low yield of our cattle is essentially due to two factors: (1) lack of proven sires, and (2) lack of right type of feed.

As regards the production of milk, the output varies widely from province to province. Assam produces less than 1 per cent of the total milk, while the United Provinces produce nearly 23 per cent. Bihar, East Punjab, Madras and the United Provinces together contribute nearly 57 per cent of the total cow and buffalo milk produced in the country. For the country as a whole there is a need for nearly three and a half fold increase in milk production to meet

the optimum nutritional requirements of our population. Those who have studied the problem will soon realize that with the resources at our disposal it is not easy to reach the target in the very near future. As a less ambitious, but more practicable project, the Government of India have a plan to increase the total milk production by about 10 per cent in five years. This increase will serve to meet the minimum nutritional quantum of 1 lb. per head per day only of the most vulnerable group in our total population. To achieve this, each province will be expected to increase its quota by 10 to 15 per cent over the present level of production.

Coming to the utilization of milk, due to our peculiar circumstances, only about 36·2 per cent of the net available milk is used for fluid consumption, and the rest utilized in the form of its products. The most important of these products is *ghee*, for which nearly 43·3 per cent of the available quantity, amounting to 2,085 lakh maunds is used annually, while curd, *khoa* and table butter account for the remaining 19·5 per cent. Realizing the acute shortage of fluid milk, one possibility of increasing the supply would be to decrease the quantity utilized for *ghee* making. Considering the present market price of *ghee*, it has become a rich man's food, not to mention the doubts cast on its quality from time to time. By increasing the supply of fluid milk, the distribution can be made more even. A cheap and efficient method for preserving and transporting milk is the crying need of the rural dairy industry.

At present the price paid by the consumers for milk in the urban areas is probably the highest in the world in spite of the fact that the milk is sold loose without any processing. Since the war, the prices have increased by 200 to 300 per cent in different localities which tends to make the distribution of available quantities all the more uneven. The high price of milk in the urban centres has been repeatedly discussed and it is largely due to the abnormal cost of housing and feeding the cattle in the urban areas. At present it is estimated that nearly 441 lakh maunds of fluid milk is consumed in the urban areas and probably an equal quantity in the form of various products, thus accounting for nearly 19 per cent of the total milk production. The complexity of urban milk problem will be evident from the fact that besides two lakh urban producers, about five lakh persons are engaged in the assembly and distribution of milk. The problem can be simplified by organizing the production on scientific lines.

About the quality of market milk, the less said the better. Fortunately due to the universal practice of boiling milk, the incidence of any disease being transmitted by milk on a wide scale is remote. While the spread of diseases through the consumption of milk thus seems to be remote, the same cannot be said of products like butter, *khoa*, ice-cream, etc. which are sold in the market too often in not a very hygienic condition and some vigilance on the part of the health authorities seems necessary. About the composition of market milk, there is no doubt that adulteration is practised on a liberal scale and it is difficult to keep a check when there are so many agencies producing and handling small quantities of milk.

This in brief is a general picture of the present-day milk problem. This picture is not too bright, but milk is such an important commodity, from whatever angle one cares to look at it, that something must be done early before the situation gets out of hand. If we all strive with one purpose leaving aside for the time being our individual fads and dogmas, the problem should not prove insurmountable. It is a task which grows bigger by postponing and the earlier we start the better. (Reproduced from *Indian Dairyman*, August 1949).

Book Reviews

VERNALIZATION AND PHOTO-PERIODISM: A SYMPOSIUM

By A. E. MURNEEK and R. O. WHYTE (Published by Chronica Botanica Co., Waltham, Mass., U.S.A., 1948, pp. VIII+196).

THIS symposium takes stock of the present position regarding our knowledge of the physiology of flowering in higher plants. Sixteen authors have contributed to it and have presented balanced reviews of researches on different aspects of the problem. An attractive feature of the book is excellent photographs of several leading plant physiologists who have made distinctive contributions in this field. The wealth of information contained in this book can be judged by the titles of chapters: History of Research in Vernalization by R. O. Whyte; History of Research in Photoperiodism by A. E. Murneek; Hormones in Relation to Vernalization and Photoperiodism by K. C. Hamner; Wave Length Dependence and the Nature of Photoperiodism by H. A. Borthwick *et al*; The Photoperiodicity of Flowering under Short Day with Supplemental Light of Different Wave Lengths by G. L. Funke; Nutrition and Metabolism as Related to Photoperiodism by A. E. Murneek; Anatomical and Histological Changes in Relation to Vernalization and Photoperiodism by R. H. Roberts and B. E. Struckmeyer; Length of Day in the Climates of Past Geological Eras and its Possible Effects on Changes in Plant Life by H. A. Allard; Vernalization and Photoperiodism in the Tropics by S. M. Sarkar; Some Preliminary Observations of Phenological Data as a Tool in the Study of Photoperiodic and Thermal Requirements of Various Plant Material by M. Y. Nuttonson; and Thermoperiodicity by F. W. Went. There are also three supplementary chapters in German: Studies on Photoperiodicity in the Tropics by E. Bünning; The Developmental Physiological Meaning of the Endogenous Daily Rhythm in Plants by E. Bünning; and Contributions to Genetics of Photoperiodism by A. Lang.

It is impossible to state briefly within the limited space of a review the present position regarding our knowledge of the physiology of flowering. It appears that all contributors subscribe to the view, originally advanced by Sachs, that some special substance or substances direct the processes that lead to the initiation of flowering, although these have defied isolation so far. It would appear that research has now progressed almost up to the limit of biological analysis of the problem and striking advances may not be expected until these substances have been identified.

The position as regards the application of these researches is, however, more fortunate. It does not appear probably that the method of vernalization will have a wide application except perhaps in those tracts where conditions of drought or flood offer advantage to a crop maturing earlier by a few days. In other tracts it would seem more profitable to use superior genotypes, if available. Low temperature treatment would, of course, be useful in genetical or similar research. From agronomic point of view the vernalization (natural) of developing embryos while still attached to the mother plant should be considered in the selection of areas for seed production and in plant introduction and the moving of seeds from one environment to another. Early strains may become late and vice versa. Devernalization as a result of a temporary period of high temperature or water-logging may also affect a number of agronomic questions.

Another application of this research is well-illustrated by the success achieved by the well-known bulb industry of Holland in preparing bulbs (by suitable temperature treatments) capable of timely flowering by Christmas, in extending the succession of blooms for the market and in conditioning bulbs for export from the northern hemisphere to the southern hemisphere so that they are at once adapted to the changed season from autumn to spring. Those keen on understanding the scientific principles underlying

these applications will find valuable information in this book.

The reviewer has but one comment to offer. In view of the important contributions of the Russian workers to this subject this excellent monograph would have gained in completeness had at least one representative worker from the Russian school contributed to it. Perhaps this was not possible due to the Iron Curtain which unfortunately separates at present the U.S.S.R. from the rest of the world.

The book includes a subject and an author index and the get-up is in keeping with the usual high standard of Chronica Botanica Company. (R. D. A.)

MANUAL OF GENERAL SILVICULTURE FOR INDIA

By H. G. CHAMPION and A. L. GRIFFITH (Oxford University Press, 1945, pp. 1-XV+ 1-329 with 2 maps, 5 diagrams and 28 plates, Rs. 25).

THIS publication appeared originally in 1938 and is known intimately to forest officers trained at Dehra Dun. It is perhaps not suitable for light reading by the non-forest man, but forestry the world over is now news for the layman as well and with the help of the index, this publication will serve to throw light on any general forestry matter in which one may become interested, in our country.

To the serious student, a word of caution must be uttered and that is that silviculture cannot be learnt from books. The forest is the real text book for silviculture and a season's original observation is superior to the study of tomes on the subject. But these tomes have their uses, because they record what others have observed and it is only by sharing their experience in a practical way that a real insight into the subject can be obtained. Some of the postulates may turn out to be perverse when tested out in the field. At the same time forest crops take long to mature and no one individual can have the monopoly of observational facts in relation to them and dependence on literature for many of the fundamental facts is inescapable for specialization.

To the land owner who wishes to go in for planting for fuel or small timber Chapter VI on artificial regeneration will give an enlightened background to matters germane to the work; also Chapter VII dealing with afforestation.

Chapter I is concerned with the locality factors of the forest, detailing the climatic and edaphic factors for forest growth, and methods adopted for maintaining the productive capacity of the site.

Chapter II deals with the growth form of trees and crops, flowering and seeding, germination of seed and establishment of the plants, growth, vegetative reproduction and inheritance of parental characters.

Chapter III deals with water, light and food relations, movements and excretions under tree and crop physiology.

Chapter IV tells us about pure and mixed crops, competitions among species, colonization and succession and forest types.

Natural regeneration is dealt with in Chapter V and tending including thinning in Chapter VIII.

Information has been used mainly from Indian sources, though in the sections on tree physiology and soil, foreign experience has had to be accepted, due to the lack of suitable Indian data. The authors have, however, not brought into the limelight the crying needs of the second phase of artificial regeneration in India relating to forest pathology, on an ecological basis and the role of trace elements, which marks the era where silviculture gets to grips with its life strings to emerge as a triumphant science for the good of any country. (J.P.)

News and Views

CENTRAL POTATO RESEARCH INSTITUTE

THE Central Potato Research Institute set up a few months back by the Ministry of Agriculture, Government of India, started functioning at Patna, its permanent location. The Institute which is believed to be the first of its kind in the East, will coordinate researh so far undertaken in various sub-stations of the Indian Council of Agricultural Research at Simla, Bhowali and Kufri and will chalk out a scheme for fundamental research on the production and utilization of the potato crop.

Potato as a nutritive food is an important item of diet. Apart from its energy value, it contains appreciable quantities of portein, minerals and vitamins B and C. In India, although the soil is suitable in most areas for potato cultivation, only about 0·2 per cent of the total crop area is under potato and the annual production is about 1,800,000 tons. Leaving aside the quantity required for seed purposes, about 8 lb. of potato are available annually per head as against about 500 lb. per head per annum in some of the Western countries.

The main obstacles in the way of increased production of potato in India are (1) absence of different varieties of potato suited to varying conditions of climate and soil in different parts of the country; (2) non-availability of sound, healthy seed in adequate quantities, at the right time and at a reasonable price and (3) the heavy toll taken by fungal, bacterial and virus diseases and insect pests. The Institute will undertake research into these problems. (*P.I.B.*)

SURPLUS WHEAT FROM THE U.S.A.

A NEWS agency reports that British grain experts are interested in Pandit Nehru's remark in New York that India would like some of America's surplus wheat for a stockpile to keep down prices in India. For several months some well-informed quarters have canvassed the possibility of India obtaining a bulk supply of U. S. grain without immediate payment. The United States can spare it with the greatest ease and indeed to its own advantage, since it has a real surplus.

In India the bulk supply would be invaluable to combat inflation. Even if none of it were ever sold, it would overhang the market and help keep down prices of Indian grain by frightening hoarders into sending their hoards to market. Supplies of foodgrain in the United States this season are the biggest on record, and wheat supplies are very big. Supply of maize, a record last season, is still bigger this season by the huge amount of 10 million tons. When more of the maize is harvested, the United States will probably have to store some grain in Canada.—*Food Bulletin*, October 24, 1949.

DEFEATING THE TSETSE FLY

UNDER a scheme sponsored in 1944 by the Imperial Chemical Industries, the late Dr F. H. S. Curd and Dr D. G. Davey discovered a new drug—Antrycide*—specific against nagana in cattle. The discovery will go a long way to protect cattle from the tsetse fly pest. The drug was perfected in the laboratories at Manchester and has been found to be a curative of all forms of trypanosomiasis. Now, it has been made a subject of field tests, under natural conditions in the fly-infested areas of Africa, to ascertain its prophylactic properties. The work, at present, is being conducted along two channels, firstly, to ascertain the length of time cattle can be kept healthy in tsetse-infested areas with a single dose of Antrycide and secondly, to establish the amount of drug needed as a standard field dose. As a long term issue, it is also to be ascertained whether or not cattle can be kept healthy indefinitely in tsetse areas and whether cattle born there develop any degree of natural immunity to the disease.

Results available so far indicate that the effect of the first administration of the drug lasts for a few months only, and if re-treated within first four to seven months, immunity for at least a year is assured. In Kenya when animals protected with Antrycide were moved into the tsetse area, no signs of trypanosomiasis were seen in their blood stream, and these, on the other hand, showed definite improvement in general condition.—Adapted from Press Note No. FA/170 issued by *B.I.S.*

***It is proposed to conduct trials in Indian cattle with this drug at the Indian Veterinary Research Institute, Izatnagar.**

AN AMENDMENT

WITH the article entitled : '*The Sugarcane Crop in the Vizagapatam District and its Weather Requirements*' by Shri A. Sankaram, appearing in the January 1948 issue of *Indian Farming*, the designation of the writer has been wrongly printed as Superintendent, Agricultural Station, Anakapalli. The writer is a Research Scholar at the Indian Agricultural Research Institute, New Delhi.—*Editor.*

NEW BOOKS RECEIVED

1. *Achievements of the Indian Central Sugarcane Committee and its Future Needs* by Datar Singh (Published by the Indian Central Sugarcane Committee, New Delhi, pp. 14, price not mentioned).

2. *British Farm Mechanization*, Vol. 1, No. 1, April 1949. Edited by H. M. Hughes (Published by Temple Press Limited, Bowling Green Lane, London, E.C. 1, pp. 46, price 2s.).

3. *Journal of the Zoological Society of India* Vol. 1, No. 1 (Published by the Zoological Society of India, Calcutta, 1949, pp. 1-70). The get-up is satisfactory but a little better cover would have added considerably to its general attractiveness. (H.K.L.)

COVER ILLUSTRATION

A Central Himalayan View from Ranikhet.

(Sketch by N. S. Bisht.)